PROGRESS IN THE TREATMENT OF MALIGNANT DISEASE *

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THE problem of treatment of malignant disease has not yet been solved. Progress has undoubtedly been made, but it is conceded by all that much remains to be done. A method more ideal than any so far employed may some day be discovered. Any investigation, however, must be limited to known methods, and the object of this paper is to try to determine if the methods now available are being employed to the best advantage and also to see if full use is being made of the knowledge already accumulated.

A survey of the Registrar-General's annual reports shows that cancer is second on the list of the main causes of death and amounts to 14·3 per cent. of the total deaths. Not only so, but if the enquiry be limited to the age-group 15 to 65 years, *i.e.* the period of man's working life, cancer is still the second most common cause of death. Here the figure is 18·2 per cent. Cancer is thus a serious economic problem and is responsible for one out of every five to six deaths during the economically useful period of life. Such a statement can be put, perhaps somewhat more dramatically, by stating that one out of every five persons listening to this paper will die of cancer, provided that the means to combat the disease remains as at present.

The number of deaths from cancer is shown by the same returns to be steadily increasing each year. The crude death-rate in 1901 was 842. By 1938 this figure had increased to 1665. The average age of the population has, of course, increased during this period, but even when correction is made for alteration in the age and also in the sex distribution of the population, the annual mortality from cancer still shows a progressive increase. This corrected figure, or as it is referred to, the standardised death-rate, has increased from 841 in 1901 to 1005 in 1938. This increase may be due to increased incidence or to more accurate certification of the cause of death. The latter factor must exist for unquestionably more accurate means of diagnosis are available to-day than ever before.

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The figures of the Registrar-General, therefore, may not be the most ideal on which to base a conclusion. Nevertheless the fact remains that so far the progress made in treatment has not been reflected in the annual returns of the cause of death.

Cancer is without doubt the most dreaded of all diseases. The slow and often painful course of the disease, the great mental suffering of the patient, the inevitable termination in death unless successfully eradicated, and the ever-increasing number of friends and relatives dying from this cause, have given rise to considerable anxiety in the public mind. The seriousness of the position has been recognised by Parliament in the passing of the Cancer Act. The present state of affairs demands the most searching enquiry and the provision of facilities for adequate treatment will probably receive greater public support than in the case of any other disease.

Enquiry into the problem has been greatly facilitated by the availability of some twelve thousand records of malignant disease in the files of the Radiotherapy Department and by the author being able to study at first hand over one thousand new cases each year. The records are of all patients referred to the Royal Infirmary and include not only radiotherapy cases but also surgical cases and even patients not having any treatment at all. Within the last three or four years these records have been specially analysed and classified and many of the suggestions to be put forward have arisen from the information so obtained.

The main faults contributing to the failure to reduce the death-rate from cancer appear to be that patients do not obtain treatment at a sufficiently early date, that when treatment is given it is not always adequate and that insufficient use is being made of past experience in order to advance treatment methods more rapidly. Evidence in support of these statements is given by Luff, who estimated that the annual number of deaths from cancer of the breast which at present amounts to seven thousand in England and Wales, could be reduced to one thousand if all cases were adequately treated in the first month of the appearance of the disease.

The principal suggestion to be put forward to overcome present difficulties is that all diagnosis, treatment and after-care of patients suffering from malignant disease be centralised. To demonstrate the advisability of this step the present position must be analysed in greater detail and the function of the central body outlined. The task is by no means an easy one,

but the suggestions to be put forward may promote further discussion, and so when the time comes a well-organised and carefully planned scheme may be put into effect.

The main functions of the central controlling body would be :—

1. To secure treatment at an early stage of the disease.
2. To secure adequate treatment.
3. To assess the results obtained from the different methods of treatment employed.
4. To plan and direct future treatment.

1. *The Importance of Securing Early Treatment*

No matter which anatomical site is selected or what histological type or grade of tumour is considered, the one outstanding fact observable in any table of results is that patients treated at an early stage do best. For example, adequate treatment of cancer of the breast at an early stage of the disease promises to give a five-year survival rate of the order of 90 per cent. Even when the same method of treatment is employed the results progressively deteriorate the greater the delay in the application of treatment. They reach zero when the disease has become widely disseminated, as no known method of treatment can save the life of the patient at this stage. No matter what improvements are made in the future it seems extremely unlikely that a patient with distant metastases will ever be cured. These advanced cases are still far too frequent and in a recent consecutive series of 615 breast cases, no fewer than 29 per cent. were in this advanced category when they were first referred for treatment. The securing of early treatment is the very crux of the problem of treatment of malignant disease and it has not yet received sufficient attention.

Early treatment implies early diagnosis and in trying to improve the present position one must enquire into the faults existing at present and see if they can be eliminated.

Discreet questioning of patients referred to the Radiotherapy Department shows that many first sought advice several months previously when the disease was at an early stage and that they were then assured that their complaint was of a simple nature. Many patients, on the other hand, do not seek advice until the condition is advanced, but it is interesting to note that these cases are usually referred to the

Infirmary immediately. It would appear that this observation is significant and that the correct deduction to be drawn is that the early manifestations of malignant disease are insufficiently known.

The fault may lie in the training of the medical student who is usually shown advanced cases because in any one ward early cases are difficult to obtain. Not only so, but such a demonstration is usually accompanied by a long discussion of the differential diagnoses. Every textbook the student reads continues and supports his clinical teaching, and each author attempts to excel in the list of differential diagnoses which it is stated can be made. No wonder the student leaves his medical school more familiar with the terminal stages than with the early signs and symptoms. He may believe, for example, that a diagnosis of cancer of the stomach is only made when the patient has constant abdominal pain, a palpable epigastric mass and has lost considerable weight; or that cancer of the tongue is a disease with a fungating ulcer, fixation of the tongue and glands in the neck.

When he goes into practice he has little opportunity to add to his knowledge, for a practitioner in a practice of average size sees only a comparatively few cases of cancer each year. Until recently he had little opportunity of returning for post-graduate instruction. So when he finds a small mobile tumour in the breast with no skin changes, no retraction of the nipple and no glands in the axilla, his training in differential diagnosis may lead him to believe that the condition is possibly a chronic mastitis, a simple tumour, tuberculosis, post-traumatic fat necrosis, etc.

With the setting up of a centralised body for the treatment of malignant disease many more cases would pass through the centre than through any one ward as at present. All cases would be very fully investigated and the early stages of the disease would receive special attention. Our present knowledge of the first manifestations of the disease would be greatly improved. The central body would be in an excellent position to improve both undergraduate and post-graduate teaching. Naturally the initial signs and symptoms would be emphasised rather than the advanced stages. Indeed the chief aim of such teaching would be to demonstrate that under certain circumstances cancer is a possible diagnosis and when these circumstances exist the patient must be referred to the central body at the earliest possible moment. The student with early

cases before him would be able to observe for himself the difficulty of making a diagnosis in the initial stages by clinical means alone. The services of the practitioners in the region would be regarded as an essential part of the scheme. Their co-operation would be secured by keeping them informed of the work of the centre and of the results obtained. In particular they would receive full reports of their own cases. In time they would come to appreciate that differential diagnosis in a possible case of cancer is no part of their duties. Textbooks so revised as to emphasise the early features of the disease would be another step in the campaign to secure early treatment.

These measuress would, of course, only operate when the patient sought advice at an early stage. There remains the question of how to encourage the others to go to their doctor as soon as they note something wrong. Direct propaganda to the public must be very carefully considered. Such propaganda could only be undertaken after the medical profession had been organised to recognise early cases. Under present circumstances appeals urging patients to seek early advice would probably do more harm than good. First of all, the patients might merely receive assurance and such assurance, if duly accepted, might actually result in the patient being treated at a later date than at present. If not assured, the patient might find himself placed on a long hospital waiting-list and not treated for a month or more. Propaganda to the public could only follow the establishment of a satisfactory medical service. The more efficient the service and the better the results obtained, the less will be required in the way of propaganda. Some work might, however, be immediately undertaken to dispel from the public mind the idea—dying only too slowly—that any disgrace is attached to the development of cancer. Economic difficulties which at the present are very real, delaying or preventing the patients from obtaining early and adequate treatment, could be overcome. Appropriate arrangements might be made for the after-care of patients in whom the disease has not been successfully eradicated. This provision, of course, applies especially in poorer households where adequate nursing and even adequate accommodation are impossible. Death from certain forms of cancer under these circumstances may arouse in the relatives and friends such a painful mental impression and such a sense of despair that if the unfortunate witness of such an event is struck down by the same dread disease, there is a great tendency to conceal the

fact and to hope against hope that any other explanation may be the correct one and that the lump or ulcer will disappear spontaneously. Hospital accommodation, adequate nursing, relief of pain and removal from overcrowded homes would do much to prevent patients seeking advice only after a long delay. Perhaps, too, every newspaper advertisement for patent medicines might be required by law to carry an additional line stating that—" Unless you receive early and complete relief, you must seek medical advice." It is not improbable that the many tons of stomach powders sold each week cause delay in the treatment of the patient with cancer of the stomach. These points with reference to the public are of some importance, but I repeat that more direct propaganda by posters, newspaper advertisements and broadcast appeals would require to be conducted with the greatest caution and that improvement in the service and in the results obtained would be the best propaganda of all.

Assuming that patients do come to seek advice earlier and are immediately referred by their practitioner to the central body, it remains to be seen how this would be organised. The responsibility of arriving at a correct conclusion, especially in the early stages of the disease, would be very considerable, but it is justifiable to believe that the opinion given would be of greater value than that of any one consultant with much more limited experience. The personnel of the centre thus called upon to bear a very great responsibility would require to take all measures in their power to establish a correct diagnosis at the very earliest opportunity. The policy of " wait and see," too frequently adopted to-day, would no longer be possible and active measures would require to be taken. Expert histological assistance would be required as biopsy would play an important part in difficult cases. It has sometimes been stated that biopsy is a dangerous procedure, but to leave a case till the diagnosis is all too obvious is still more dangerous. Expert radiological examination would be another feature of such an organisation. In the radiological service special training would be necessary, for sufficient attention has not yet been paid to the earliest signs detectable by this means of examination. Those workers like the main body would gradually build up knowledge and they too would require to follow up the diagnosis which they have made so that errors would be gradually eliminated. When the first examination failed to reveal any evidence of malignant disease,

the patient would be required to report again so as to check the accuracy of the original conclusion. In certain situations, for example in the mouth, the dangers of faulty interpretation of the Wassermann reaction will be fully understood. A positive reaction will be taken as meaning merely that the patient has at some date or other acquired syphilis, and it will not be assumed that the lesion in the mouth is necessarily syphilitic. Rather it will be borne in mind that syphilis and cancer of the mouth often co-exist, and that in doubtful cases a biopsy of the actual lesion is the only useful means of differentiating.

As soon as a diagnosis of malignant disease has been established or confirmed at the centre, provision must be made for immediate treatment. The central organisation must therefore have adequate staff, adequate apparatus and other facilities for treatment and adequate bed accommodation. Waiting-lists for treatment must be abolished entirely. A central scheme would obviously be able to provide this immediate treatment much more economically than multiple small centres.

2. *The Securing of Adequate Treatment*

The centralisation of all treatment again appears to be essential. Outstanding amongst the arguments in favour of this is the importance of the first method of treatment. It is not always appreciated that if the first treatment fails, any subsequent procedure is unlikely to be successful. The statement applies with special emphasis in radiotherapy and concerns even such simple and easily curable lesions as rodent ulcers. Inadequate radiotherapy so alters a rodent ulcer that it becomes extremely radio-resistant and attempts at further treatment almost always fail. If it is impossible to excise such a recurrence, the end-result is terrible in the extreme, as the tumour slowly spreads and destroys the features of the patient. In a well-conducted central organisation such inadequate methods would not be tolerated.

Quite apart from this, economic factors would alone demand that radiotherapy with its expensive apparatus and highly specialised technique would be centralised. It might be said that the argument does not apply with the same effect in the case of surgical treatment. Decentralisation of surgical treatment, however, would tend to slow down advance. An operation conducted outwith the centre would be undertaken by a surgeon having less experience in this type of work.

Early cases appear sometimes to invite less radical removal, and unless controlled the whole advantage of securing early diagnosis would be thrown away. Case records of patients suffering from melanotic carcinoma alone show the justification for this statement. The same careful scrutiny of the work could not be made and there would be less incentive to improve technique. The stimulation to do the best possible within the centre can scarcely be exaggerated. In any case, if it is agreed that a central organisation is necessary for diagnosis, the patient would already be at the centre when the question of treatment arose and it would naturally follow that the treatment should also be undertaken at the centre.

The definition of adequate treatment is not easy, as the extent of the treatment given would vary according to the type of case. The earlier the stage of the disease the greater should be the margin of safety. The great importance of the first method of treatment must also always be kept in mind. There should be no restriction placed on the use of any particular method on account of insufficiency of personnel or of apparatus. Analysis of past work would indicate where improvement could be made and there will thus be a constantly changing definition of what is implied by the term " adequate treatment."

3. *The Assessment of Results*

From time to time throughout this paper criticism has been made of past work. Some of the criticism has been adverse. It has not been made with any intention of detracting from the value of previous efforts, for it is only too easy to do this in any subject in which our knowledge is advancing. The criticism has been made in the course of an attempt to assess the value of what has already been accomplished and made solely for the purpose of demonstrating where improvement might be made. Assessment of work is essential if we desire to profit from previous experience.

Too often at present no real assessment is made and the success of a hospital or of a hospital department is judged by the number of patients examined or treated within its walls. If each year there is a progressive increase in the numbers the work is considered to be satisfactory. Under such circumstances a department may continue for many years to treat many cases of cancer without ever having cured a single patient. If large central organisations be set up for the treatment of

malignant disease the value of the work done in each centre would require to be most carefully analysed and the results so obtained would be considered satisfactory only if they bore comparison with those of other centres.

The centralisation of all work would result in greater uniformity of records and analysis of these records would thus be simplified. It is by no means an easy matter to analyse results, and so many factors require to be taken into account that it is necessary to make use of some special system. After consideration of many methods, the author finally selected the "punched card system" and suitably adapted it for this special purpose. The method has exceeded all expectations and results can be quickly and accurately determined under a great variety of circumstances. Some such flexible and easily used system must be employed, for in a comparatively short period of time the number of records may run into many thousands.

The centre would, of course, be concerned not only with its own results but would require to compare its findings with those of other centres. Herein lies a difficulty which so far has not been satisfactorily overcome. At present almost every worker has his own standards and his own method of assessment. Presumably, however, all large central schemes would be in some way co-ordinated. It should thus be possible to define accurately anatomical sites, the stages of advancement of the disease, the histological types and grades of tumours and to lay down for all centres a uniform method of assessing results. Such a step would be of great importance and would be comparatively easily carried out after the centres had been established.

Of all the definitions to be drawn up by the co-ordinating body the most important is the method of assessing results. Considerable confusion exists at present and it is very difficult to arrive at a correct conclusion regarding the present position. The evidence published is at times actually misleading. One might easily gain the impression that great advances are being made in the treatment of cancer. But, as already indicated, the returns of the Registrar-General not only do not support this conclusion but actually indicate that the death-rate from this cause is increasing each year. If progress is to be made we must first clearly understand what is at present being achieved. We must have some standard by which this can be assessed and this same standard

must be capable of being used as a measure of future progress.

What standard, then, is to be accepted? In drawing up any basis of assessment the personal factor must be eliminated so far as is possible. This can be accomplished in malignant disease more easily than in any other condition because results can be assessed on the simplest of all standards, namely the survival rate. Such a basis is possible, because in cancer if treatment is unsuccessful the patient usually dies in a fairly short period of time. It is equally true in this disease that if the patient is restored to health the cure can be attributed to the treatment given. The survival rate is, of course, obtained by expressing the number of survivors as a percentage of the total cases, but fair comparison can only be made *if no cases are excluded from the total.* When large centres for treatment are set up, it would appear that the survival rate should be expressed as a percentage of the survivors from all cases of cancer occurring in the area served by the centre. Thus patients receiving incomplete treatment or even no treatment at all would not be excluded from the total. It is perfectly justifiable to do this, because cases receiving either incomplete treatment or no treatment are failures to the methods of treatment available. Adoption of this principle would leave little room for the personal factor and would also put a stop to competition based on the selection of early cases of the disease in otherwise healthy patients. Better results can always be obtained by more careful selection of patients. Compulsory publication of results might tend to intensify such competition and results would become meaningless. There would also be real danger of the moderately advanced case being denied treatment, for the treatment of these cases may spoil statistics. Failure to adopt this basis of assessment is the cause of the present confusion in the literature. Published survival rates relate only to a very definitely selected group of cases. Usually only patients actually completing full treatment are included in the total on which the percentage is expressed. The information stated in such articles is not a means of determining the progress made and is not an answer to the question—What can be done for cancer as a whole or in a particular anatomical site?

If a five-year survival rate be adopted as the basis on which progress will be determined, it should be noted that this figure takes into account not only the method of treatment employed

but also the success of any measures taken to secure treatment at an early stage of the disease. In other words, it is a measure of the whole organisation and activities of the centre. It would represent the basic figure by which the work of one centre could be compared with that of another. A rise in the five-year survival rate (as defined) would be accompanied by a fall in the standardised death-rate and it would be a real measure of progress year by year.

As soon as we depart from this basic means of comparison the personal factor creeps in. But if we desire to compare the value of treatment given in different centres it is necessary to make comparison by stages. Clear definition of stages will reduce the effect of the personal factor to some extent.

It should be noted that this comparison of treatment is a comparison of the value of all the treatment given irrespective of the number of times the patient was treated. If we should desire to assess the value of any particular method of treatment and to compare this method with another, then the symptom-free rate as defined below must be used. By the symptom-free rate one means the percentage of patients showing no evidence of recurrence at any time since the first-planned treatment was given. The symptom-free rate (as defined) must be used, for in any analysis of treatment only the first-planned treatment can be usually considered. Any subsequent treatment is always modified by the previous treatment. An example will make this point clear. If a rodent ulcer be treated by radium as the only means of treatment deemed necessary at the time, and if the lesion should recur subsequently and be surgically removed and cured, then the case cannot be regarded as a cure by radium plus surgery but must be regarded as a failure to radium treatment. It cannot be considered as a cure for surgery, for surgery alone might not have succeeded. From the above it follows that a patient may be alive (and even free from disease) at the end of five years in spite of the fact that the first method of treatment was a failure. The survival rate, then, might actually be misleading in the assessment of the value of the first method of treatment—the only method which can be analysed. Because recurrences for the first time are comparatively uncommon after the third year, it is permissible to make use of a three-year symptom-free rate as a means of comparing treatments. It is thus possible to assess the value of treatment in a shorter period of time and by this step the rate of progress may be speeded up.

The five-year survival rate would determine the value of all the work of the centre, and if comparison be made by stages it would be a means of comparing the value of the treatment given at each centre. To compare the value of any one method of treatment with that of another the three-year symptom-free rate should be employed. Co-ordination of the work of all large centres would permit uniform methods of comparison, such as have been suggested, being generally adopted.

4. *Planning of Future Work*

Unless a problem is tackled along very carefully planned lines it is possible to do much work and yet fail to make any real progress. There are still many gaps in our knowledge and if care is not taken our information may remain very incomplete for many years to come. Once a method of treatment has been introduced, there is a tendency to go on using it and the application of this treatment is often the only concern of the surgeon or the radiotherapist when undertaking treatment. Instead of each worker contributing to improvement in technique, it is frequently left to a very few to suggest still better methods. Even when better methods of treatment are described, older methods may continue to be used because of failure to read and appreciate the literature. The approach to the whole problem under existing conditions is essentially individualistic and each worker has often too little material for study and too little time to profit from his own limited experience. Progress under these conditions is unlikely to be either rapid or methodical.

Centralisation of all treatment would again provide a means of overcoming these difficulties. By this means a sufficiently large number of patients would become available and a method of treatment might be assessed in a few years. The average general surgeon, not specially interested in malignant disease, is only able to make a useful contribution when he approaches the age of retirement. Even when this stage is reached his total number of cases in some comparatively common type of cancer may be of the order of only three hundred. Owing to changing technique over the period and consequently to the small number of cases treated by any particular method, it is very difficult to evaluate the methods of treatment employed. When centres for treatment are formed these should be sufficiently large and the amount of treatment given sufficiently great to permit of a

useful analysis of any one year's work. Just how great the number of patients treated requires to be is insufficiently appreciated. It is, however, impossible to compare results in different anatomical sites and it is customary to make some thirty to forty sub-divisions according to the site of origin. Again, the value of treatment varies greatly according to the stage of advancement of the disease and the results of different techniques must be compared by stages. Four stages are usually made. From what has been said it is obvious that a centre, treating less than, say, two thousand cases a year, will not be able to evaluate satisfactorily any one year's work. As evaluation of work is the means by which progress is made, it follows that the fewer the cases treated each year the slower will be the progress. These statements assume that conclusions will not be based on small numbers of cases, for it is generally agreed that even in the simplest problem it is dangerous to express an opinion on less than one hundred cases. When it is realised that these hundred cases must be all from the one anatomical site and all at the same stage of advancement, the argument in favour of centralisation is a very strong one.

Review of existing conditions reveals yet another reason for centralisation. At present there is much rivalry between the surgeon and the radiotherapist and even in radiotherapy alone, between the radium specialist and the X-ray specialist. A worker in any one field is insufficiently aware of what is happening in the other's province. A certain amount of competition is very desirable, but when it extends to the point that a patient may not receive the best method of treatment, it fails to have any merit at all. In a large central organisation all the different workers would be in close personal contact, and representatives of each available method of treatment would consult together concerning the method of treatment to be employed. A patient would not receive a particular method of treatment by reason of the accident of his direction. After careful and complete examination and with the full knowledge of all the methods available, the treatment believed to be best by the surgeon, by the radium therapist and by the X-ray specialist would be carried out. The aim of all would be to treat by the method most likely to cure the patient of his disease.

Up to the present there are only three methods of treatment to be considered—surgery, radium and X-rays. In trying to visualise the work of the future and the lines along which it will

proceed, it might be profitable to consider each of the three methods in turn.

Surgery for many years was the most important method of treatment available to the cancer patient. The period of advancement began with the introduction of aseptic surgery. Through the years operative procedures gradually became more radical and in many situations if the disease was reasonably localised the patient could be permanently cured. More extensive cases can, however, only be cured by still more extensive removal of tissues. But operations for the treatment of malignant disease are already amongst the most radical performed and bearing in mind the position of the patient, it is almost inconceivable that surgical advancement can proceed much further. Indeed it is likely that some of the more extensive operations will be abandoned as radiotherapy advances. Already there is an indication of this and it is uncommon nowadays to hear of resection of the superior maxilla or of hemiglossectomy, and it seems highly improbable that such operations as œsophagectomy, total cystectomy and pneumonectomy will continue to survive. These operations are only possible in a very limited proportion of cases ; they have a very high operative mortality and even when immediately successful they do not necessarily cure the patient. There are, however, many sites where excision of the tumour continues to give the best results and so long as surgical treatment remains superior it must not be replaced by radiotherapy.

Treatment by radium has a much shorter history. When first introduced its possibilities were considered to be almost unlimited. The scarcity of the substance and its high cost undoubtedly contributed to this mistaken idea. The demand grew for more and yet more radium and the history of the use of some of these larger quantities is by no means in keeping with the prophecies advanced. As knowledge extended it came to be realised that the employment of radium was a procedure that could not be undertaken lightly. It was slowly appreciated that the action of radium and of X-rays was essentially the same and that it was better that both these methods of treatment should be under the one control as advance in one method often contributed to advance in the other. In the earlier days great difficulty arose in exactly repeating a treatment which had been found to be successful. This was because no accurate system of dosage was available. (Everyone now knows that a statement of milligramme-hours is almost meaningless.) It

was not until 1937 that an international unit of dosage was adopted. This work made it possible to repeat with reasonable accuracy any result previously obtained.

For many years X-ray treatment suffered from the same difficulties as radium treatment, but a physical basis of dosage was adopted at an earlier date. The unit of X-ray dosage was defined at the International Congress in Paris in 1931, and it is interesting to note that when the unit of radium dosage came to be defined six years later the same physical unit was accepted. As already indicated, it is now recognised that X-rays and radium have the same biological action. The use of one or the other is determined by physical problems and independent radium and X-ray therapists should no longer exist.

Advance, therefore, has permitted X-ray and radium treatment to be regarded as a single method. The term "radiotherapy" has been introduced to denote treatment by either of these two agents, and it is convenient to consider the future of radiotherapy as a whole.

The discovery that the gamma rays of radium and the rays from an X-ray tube had the property of destroying malignant cells and, if employed in the correct dosage, of inflicting only minor damage to the normal healthy cells, seemed to offer a solution of the problem of treatment of cancer. By this means vital structures which could not be surgically removed and which were embedded in malignant tissue might be so treated that all the malignant cells would be destroyed while the important organs would remain to continue their function. More extensive areas of the body might be treated, thus bringing new hope to advanced cases. It was soon discovered that, like surgery, radiotherapy has its limitations. In the first place, certain tumours are radio-resistant to a degree that does not allow of their selective destruction. Again, it has been found that while treatment in some situations may be more extensive than is possible by surgery, there are limits to the total radiation which the body will tolerate. If too great an area is treated marked constitutional disturbance takes place. However, provided that the tumour is reasonably sensitive, radiotherapy has certain advantages over surgery. In suitable cases radiotherapy can just as certainly cure the patient and anyone who doubts this must be quite unfamiliar with modern radiotherapy. Even when structures essential to life are involved the patient may still be treated. This point is well seen in

certain brain tumours. Because the normal structures are not removed there is less interference with function and less subsequent disability. Support for this statement is to be found in cancer of the tongue and cancer of the larynx. Wider areas may be irradiated than excised by surgery and in consequence there is less likelihood of outlying cells being left behind. In lesions of the face where a good cosmetic result is desirable, this point is of considerable importance. Quite apart from attempts to cure the patient of his disease, palliative treatment by radiotherapy is often possible when little or nothing can be done by surgery. Large tumours interfering with respiration or swallowing may be diminished in size and the patient's termination made less miserable. Ulcerating lesions may be induced to heal and the mental suffering of the patient diminished. But perhaps the most important palliative function of radiotherapy is the relief of pain in bone metastases.

Because of these advantages radiotherapy has in the last few years come to be the most important method of treatment of cancer. In the Royal Infirmary in recent years just over 50 per cent. of patients were treated by radiotherapy and a further 25 per cent. had combined treatment by radiotherapy and surgery. Only 25 per cent. had surgical treatment alone. I have already pointed out that modern radiotherapy which is based on exact physical measurements is only a very few years old and certainly does not exceed ten years. Every radiotherapist is aware of the vast amount of work to be done before the full possibilities of this new method are realised. Radiotherapy may be said to have its future before it.

In planning of future centres of treatment the above point must be fully kept in mind and very adequate provision made for radiotherapy. But, and this is a very important point, it will not be sufficient to plan merely for accommodation and apparatus. It is most essential that provision should be made for the more adequate training of radiotherapists. At present there are quite insufficient trained radiotherapists to undertake the vast amount of work they will be called upon to do in the future. It takes many years to acquire the knowledge already accumulated and it is doubtful if provision is yet being made along the correct lines. To many a radiotherapist is some sort of medical physicist. It cannot be too widely appreciated that a radiotherapist is primarily a clinician with a sound knowledge

of pathology and that the physical side of his duties is small in comparison. The days are gone when the radiotherapist was not expected to be able to make a diagnosis for himself. Because he sees a very large number of patients each year he ought, and indeed must be able to arrive at a diagnosis as correctly as the surgeon. He is confronted by the same problems of judgment before treatment is undertaken and must be able to weigh the advantages and disadvantages of the treatment contemplated. He must be able to decide just when treatment should be radical and when it should be incomplete or palliative, or even when no treatment would be better for the patient. In some respects his difficulties are even greater, for the surgeon has only to decide if a tumour is removable, the radiotherapist must be sufficiently familiar with pathology to know if the tumour will respond to radiotherapy. Even in small superficial tumours the problem of the radiotherapist is greater than that of the surgeon, for excision of the growth is simple in comparison with treatment by means of radiotherapy. Clinical experience and a sound knowledge of pathology are essential parts of the radiotherapist's training. He must, of course, be fully aware of the physical properties of the agents he employs and so that the patient will be treated by the best means available he must know what can be accomplished by surgery. It is not too much to expect that in future radiotherapists holding responsible positions will be required to have a higher qualification in surgery. Because so much requires to be done in this field it might even be advisable that radiotherapists should have some training in research work. These standards are high, but appear essential if progress is to be made on a wide front and not left to a few. It cannot be emphasised too strongly that drastic revision in the training of the radiotherapist is a very urgent and important matter.

However important the treatment of the individual patient may be, it is still more important that work should be planned so that technique may be advanced. Advance implies the trial of new methods. New methods will be suggested by analysis of the work already done. In order that progress will be made in a reasonable period of time these new methods require most careful consideration beforehand and most careful direction when they are undertaken. Work in the future must be planned and directed and not allowed to advance more or less by accident. When work is

undertaken by many individuals all working along independent lines with each worker having so little material that it is difficult to draw conclusions, advance on a planned basis is scarcely possible. Centralisation permits of co-ordination of work and of progress being made on predetermined lines. This planning of work is very important. It should be noted that it can only be undertaken by workers actively engaged in treatment and able to draw conclusions from first-hand information. The staffing of the centres should be sufficient so that the personnel will have time not only to administer treatment but also to advance treatment.

In conclusion, I trust I have not disappointed my audience by having failed to suggest new and spectacular methods of treatment. It is very unlikely that advance will be made in this way. Rather I have tried to indicate how progress can be made by utilising to the full the methods of treatment already available. Early treatment of the disease, careful consideration of the first method of treatment, accurate and regular assessment of what has already been done and predetermined planning of future work will accomplish a very great deal. It is not too much to expect that if we make the best use of our present knowledge, cancer will become the most curable of all the more common serious diseases. It is highly probable that more will be accomplished than in the case of heart disease and tuberculosis, the first and third most common causes of death. But advance will not just happen, it will require careful thinking and determined effort. It has been suggested that centralisation of all work will permit of effective progress being made.

In the course of the paper I have mentioned certain difficulties in our present system. It is scarcely necessary to add that such criticism does not apply particularly to Edinburgh. Indeed, I would go further and state that there must be few hospitals in the country where there is greater co-operation between the Surgical staff and the staff of the Radiotherapy Department, and I would like to place on record this very happy association. Without it much of the progress made in the Department would not have been possible.