REPORT ON MEETING ON PRACTICAL METHODS OF ASSISTING RADIOTHERAPY CENTERS IN LESS-DEVELOPED AREAS

International Atomic Energy Agency/World Health Organization

Montreal, Canada, September 4—6, 1962

In 1959 and 1962 the International Atomic Energy Agency and the World Health Organization jointly convened two meetings of experts in radiotherapy and radiation physics. The first meeting was held in Vienna from 3—5 August, 1959; the second in Montreal from 4—6 September, 1962. Although the two meetings took place under different titles and with different participants, they were both concerned with the development, organization and practice of radiotherapy, with particular reference to high energy radiation. The Chairman of both meetings was Professor Sir Brian Windeyer.

It was the intention of the 1959 Vienna meeting to produce basic recommendations which would be of value to all authorities responsible for radiotherapy in cancer treatment, to those considering the establishment of radiotherapy centers, and to practising radiotherapists and radiation physicists. The recommendations of the meeting were drawn up with a view to giving practical guidance rather than as a contribution to fundamental knowledge on the subject.

The recommendations of the 1959 meeting were published, in various languages, in a number of radiological journals, and also in booklet form, together with some background information, under the title "Use of Radioisotopes and Supervoltage Radiation in Radiotherapy: Present Status and Recommendations" (International Atomic Energy Agency, Vienna, 1960; copies of the booklet are still available in English, French, Russian and Spanish).

The 1962 Montreal meeting was conceived as a follow-up meeting in which the subject matter of the earlier meeting would be reconsidered with particular reference to the problems of developing countries. Some of the topics which were mentioned only briefly in the first meeting were therefore dealt with in more detail, together with other topics of special interest to developing countries.

List of participants. Chairman: Prof. SIR BRIAN WINDEYER, Meyerstein Institute of Radiotherapy, The Middlesex Hospital, LONDON W. 1, England; Members: Dr. H. F. BATHO, The British Columbia Cancer Institute, 2656 Heather Street, VANCOUVER 9, Canada; Dr. JEAN BOUCHARD, Radiologist in Charge, Division of Therapeutic Radiology and Isotopes, Royal Victoria Hospital, MONTREAL 2, Canada; Dr. F. T. FARMER, Head, Physics Laboratory, The Royal Victoria Infirmary, NEWCASTLE-UPON-TYNE, 1, England; Dr. JOHN HALE, President, American Association of Physicists in Medicine, Department of Radiology, Hospital of the University of Pennsylvania, PHILADELPHIA 4, Pa., USA; Dr. SAAD HASAN, Radiotherapist, Republic Hospital, BAGHDAD, Iraq; Prof. SVEN HULTBERG, Radiumhemmet, Karolinska sjukhuset, STOCKHOLM 60, Sweden; Prof. GAMAL EL DIN MASSOUD, Alexandria University Hospital, ALEXANDRIA, UAR; Dr. JAMES J. NICKSON, Chairman, Department of Radiation Therapy, Memorial Hospital for Cancer and Allied Diseases, NEW YORK 21, N. Y., USA; Prof. JENS NIELSEN, Radiumstationen, Strandboulevarden 49, COPENHAGEN Ø, Denmark; Dr. M. O. ROXO NOBRE, Presidente da Sociedade de Radioterapia, Instituto Central da Associaçao Paulista de Combate ao Cancer, Rua José Getulio 211, SÃO PAULO, Brazil; Dr. K. M. RAI, Chairman, National Delegation to the Xth International Congress of Radiology, "Lalith", 110/1, Mount Road, MADRAS 18, India; Dr. S. K. STEPHENSON, Physics Department, Christie Hospital and Holt Radium Institute, Withington, MANCHESTER 20, England; Dr. KEMPO TSUKAMOTO, Director, National Institute of Radiological Sciences, 250, Kurosunacho, CHIBA-SHI, Japan; Prof. Ag. MAURICE TUBIANA, Chef du Département des Radiations, Institut Gustave-Roussy, 16 bis, Av. P. Vaillant-Couturier, VILLEJUIF (Seine), France; Prof. Dr. Ing. F. WACHSMANN, Leiter des Institutes für Strahlenkunde der Universität, Krankenhausstr. 12, ERLANGEN, Germany; Prof. G. A. ZEDGENIDZE, Chairman, National Delegation to the Xth International Congress of Radiology, Chairman, Joint Scientific Institute of Roentgenologists & Radiologists, Ministry of Health Protection, Solyanka 14, MOSCOW, USSR; Technical Adviser to Prof. MASSOUD: Prof. MAHMOUD EL SAYED MAHMOUD, Cairo University Hospital, CAIRO, UAR; Unable to attend owing to sickness: Dr. V. A. PETROV, Chief of Physical-Technical Department, Central Scientific Research Institute for Medical Radiology, LENINGRAD, USSR; Scientific secretaries: Drs M. COHEN and K. C. TSIEN, Section of Medicine, Department of Research and Isotopes, IAEA; Dr. FINN DEVIK, Radiation and Isotopes, WHO; Secretary: Miss FELICITAS SCHACHERL, IAEA.

REPORT

I. Terms of reference

The deliberations of the working party were directed towards assisting developing countries in the application of radiation sources in cancer therapy.

II. Introduction

It is desirable for a nation considering the establishment of radiotherapy centers to evaluate the overall needs of its people and to arrive at a decision as to the necessity for increasing its effort against cancer. There is no doubt that radiation therapy is, and may well remain, an essential element in the medical effort to treat cancer patients, and if a proper organization for the treatment of cancer is developed an efficient radiotherapy service is therefore essential.

The recommendations made by this working party are based on the Report of the Study Group on the Use of Radioisotope Teletherapy Units and Supervoltage Radiation in Radiotherapy, 1959. (Use of Radioisotopes and Supervoltage Radiation in Radioteletherapy; Present Status and Recommendations. IAEA, Vienna 1960.) The working party accepted

the organization detailed in the 1959 Report, Parts I, II and III, as the basic minimum for an efficient radiotherapy service, but considered that the following changes in emphasis are appropriate in the light of further experience with supervoltage therapy:

(a) Caesium-137 or any other radioisotope emitting radiation of energy less than 1 MeV should not be regarded as a form of supervoltage. Suitably designed caesium-137 units can, however, be used as substitute for orthovoltage X-ray machines.

(b) Greater emphasis should be placed on the need for physics services. In addition to trained physicists, who should be employed full time in radiotherapy, attention should be drawn to the necessity for the provision of adequate physics laboratories and equipment.

(c) Attention is drawn to the desirability of having relatively uncomplicated machinery for routine treatment, where there are difficulties in adequate maintenance.

III. The establishment of radiotherapy centers

A radiotherapy center should provide acceptable medical and scientific conditions for the treatment of cancer patients by means of radiation. This can be done only if the center is related to the medical and scientific community as a whole because, while radiotherapy is an essential medical element in the treatment of cancer, it is not the sole means for so doing. Co-operation with other medical specialities is therefore necessary. Similarly, continuing contact with the scientific community will ensure that appropriate scientific developments will be applied to the patients.

In order to provide the necessary conditions for the practice of radiotherapy, the radiotherapy service should be set up in close association with other clinical departments, and also with the basic medical sciences. It is therefore desirable that a radiotherapy center be placed within a medical teaching institute.

The working party considers it important that a radiotherapy center should accept its responsibilities in the training of personnel at both undergraduate and postgraduate level. Professional staff, both medical and non-medical, should undertake the teaching and training of radiotherapy personnel. Furthermore, some instruction in radiotherapy should be given to all medical students, so that they can be provided with an overall picture of cancer treatment. Such instruction would also encourage subsequent recruitment of radiotherapy trainees.

A radiotherapy center should also provide facilities for research and development work and professional staff, both medical and non-medical, should be allowed and encouraged to participate in such research.

The radiotherapy center must be in the charge of a radiotherapist. The physical conditions of treatment with ionizing radiations are complex, and their accurate planning and realization are essential for the patient if his cancer is to be controlled with minimal likelihood of damage to normal tissues and if the staff and public are to be guarded against overexposure to radiation. The radiotherapist must therefore be assisted by a physicist responsible to him for all statements relating to the absorption of ionizing energy in the patient, staff and the environment.

The professional staff must furthermore be supported by technical staff, such as radiotherapy and physics technicians, so that they may effectively discharge their responsibilities. In addition, it is important that an engineer or technician capable of maintaining and servicing apparatus and equipment be available at all times.

IV. Responsibilities and duties of radiotherapy personnel

A—Radiotherapist

Since the most important part of a radiotherapist's work concerns the treatment of malignant diseases, the following details refer specifically to his duties with respect to this type of disease.

1. *Clinical duties.* The radiotherapist collaborates with his clinical colleagues in diagnosing the disease and in making the fundamental decision as to whether or not it should be treated by radiotherapy. He is responsible for the medical care of the patient undergoing radiotherapy. He is also responsible for ensuring that adequate records of the patient and his treatment are kept.

2. *Treatment planning.* The aim of treatment planning in radiotherapy is to irradiate a defined volume of tissue and to deliver to it a dose considered as optimum. The radiotherapist is responsible for this task; he is helped by physicists and technicians but his responsibility remains complete. His minimum duties in treatment planning are the following:

(a) Localization of tumour; delineation of the target volume; determination of the relation of the target volume to the external contour of the body in the treatment position and to neighbouring structures.

(b) Choice of the type of radiotherapy, e. g. external beam therapy or interstitial therapy.

(c) Deciding the dose: total absorbed dose in the tumour, fractionation, overall time and number of sessions.

In some cases his work for treatment planning can be limited to these items. Usually, however, in conjunction with the physicist, he also chooses the best way of delivering radiation to the patient.

After estimation of the absorbed dose within the body of the patient by the physicist he must satisfy himself as to the dose received by the radiosensitive tissues in order to be sure that none of them receive a dangerous dose.

3. *Conducting the treatment.* (a) Clinical examination of the patient at least twice weekly, in order to judge the effects of the radiation; (b) Overall verification of the technician's work especially as regards the positioning of patients before irradiation and the absence of any change of position during treatment.

4. *Follow-up of the patient after treatment*

5. *Radiation protection.* The senior radiotherapist is responsible for protection of his staff against radiation.

6. *Teaching and Research.* As already indicated, an important part of the radiotherapist's work may lie in the fields of teaching and research.

B—Physicist

Generally speaking, the responsibilities of the physicist fall into three categories: services related to the treatment of patients, teaching and research. The amount of time he will spend on each of these will depend on the state of development of the radiotherapy department and the hospital with which he is associated.

As minimum duties, the physicist shall be responsible to the radiotherapist for:

1. All aspects of radiation dosimetry;
2. Collaboration in treatment planning;
3. All physical aspects of radiation protection;
4. All physical aspects of the use of radioisotopes;
5. Design and construction of ancillary apparatus, such as beam directing devices;
6. Overall supervision of maintenance of equipment;
7. Advice on the choice of new radiotherapy and radioisotope equipment and building design problems.

C—Radiotherapy technician

In general the duties of the radiotherapy technician are to assist the radiotherapist to plan and execute the treatment of the patients, and to record relevant information concerning the treatment. The radiotherapy technician is directly responsible to the radiotherapist for these duties, which may include:

1. Assisting the radiotherapist in the day-to-day treatment of the patient, including positioning the patient for treatment, verification throughout the irradiation that the desired position is maintained, and otherwise assisting the radiotherapist as required in the care of the patient.
2. Preparing equipment for daily use, for example warming-up X-ray machines, calibrating treatment units (under the general direction of the physicist) and recording the value obtained.
3. Using beam directing aids, including field localizing films.
4. Assisting the radiotherapist in the preparation and use of positioning aids, such as body cast, moulds, etc.
5. Maintaining records of the factors of treatment. These will include statements of exposure dose, treatment time, relevant calculations, etc.
6. Assisting the radiotherapist in the therapeutic use of sealed and unsealed radioisotopes.

V. Working conditions

As already emphasized, radiotherapy should be carried out within the general framework of medical and surgical services and should be closely integrated with other branches of medicine. The aim should be to develop a system whereby the radiotherapist is a competent clinician who is a full partner in the team work necessary for the treatment of cancer. He should be sufficiently trained and of such caliber as to have clinical control of patients and be able to have hospital beds under his own control.

In view of the variety and technical nature of the tasks which the radiotherapist must perform and the grave handicap which a dispersion of his activities among various occupations presents both for him and his center, it is desirable that, as far as possible, he should devote his full time to radiotherapy in a single place of work. To this end adequate remuneration must be provided. In this way will it be possible to gain the maximum value from the personnel and equipment of a radiotherapy center.

The physicist must be recognized as a full working partner with the radiotherapist. He must be given facilities which will allow him not only to meet the day-to-day clinical needs of the department but also to make fundamental contributions to the treatment of cancer by radiation. To this end he must have:

(a) Adequate laboratory space and instrumentation;
(b) Machine shop facilities;
(c) Competent technical assistance as the development of the department merits;
(d) Opportunity for research.

In order to attract a man of suitably high caliber, the salary and career prospects must be commensurate with those obtained in comparable scientific positions.

Adequate library facilities and the opportunity to attend meetings are also essential to all personnel.

VI. Training and assistance

Training of staff is one of the greatest problems in the building up of radiotherapy services. The following lines of approach are considered to be important.

A—Fellowships

It is recognized that effective operation of a fellowship programme is one of the best means of achieving improvement in radiation therapy. It is urged that the number of fellowships in radiotherapy and radiation physics be increased and their existence made known on a wide scale. The working party agreed that the operation of the fellowship programme should be integrated with the overall planning leading to the establishment or development of a center for radiation therapy.

The fellowship programme should include opportunities for training for persons with no prior experience in radiotherapy or radiation physics as well as arrangements for shorter periods of time for persons whose qualifications may range up to and include full competence in their field and who wish to obtain experience in a special facet. A training grant may be necessary for a few months only or may be required for a three year period in the case of a person who needs full training.

As noted in the 1959 report, the larger teaching centers in all countries should recognize an obligation to assist the sponsoring organizations to train individuals in this field.

In the course of the discussion of the working party on fellowship training, a number of practical points emerged. Although these matters are already known to the IAEA and WHO, it was considered worthwhile to bring them forward again for the sake of emphasis.

1. *Language barriers.* It is necessary that a Fellow who is to receive all or most of his radiotherapy training have a good working knowledge of the language of the country to which he is assigned. If this condition is not satisfied the value of the training is reduced. This is particularly true for medically-qualified Fellows, since ability to communicate easily and accurately with patients is essential to their training.

2. *Early communication between trainee and training center.* It is suggested that, in all cases, the trainee be urged to write to the prospective training center at as early a date as possible and that the training center should communicate with him. This would allow an interchange of ideas about his desires and needs and permit the center to recommend reading material. Much time could thus be saved both by better definition of his training programme and by prior acquisition of basic knowledge. The early contacts will facilitate the definition not only of the programme but also of the length of the fellowship.

3. *Level of knowledge.* It is unfortunately true that the level of knowledge presumed by the sponsoring organization and by the training center is not in fact always met by the trainee. As mentioned above, early communication between the trainee and the institution responsible for the training would do much to clarify this point. In some instances it may be necessary to revise the proposed programme in such a way as to render it appropriate to the candidate's actual level of knowledge. The decision should rest with the training director who may also recommend, if necessary, that the period of training be extended.

4. *Assurance of a position after completion of training.* It is recognized that this is a difficult problem. Many training centers have had the unhappy experience of training excellent Fellows who, upon return to their home countries, have found no suitable positions. This problem is such a serious one, both for the Fellow and for the training institution, that it is felt that fellowships in radiotherapy should not be granted unless a suitable post is assured for the returning Fellow.

The sponsoring organizations should therefore seek by all appropriate means assurance that the interested governments understand the gravity of this problem and the need for making every effort to ensure suitable working conditions for the trainee on his return, which may include the provision of certain necessary items of equipment.

5. *Timing of fellowships.* Many centers which accept Fellows have organized training programmes which begin at a certain period of the year. It is urged that, in such cases, fellowships should be timed so as to fit in with these programmes. Otherwise months may be wasted and the value of the fellowship considerably reduced.

6. *Selection of Fellows.* The number of candidates for fellowships in radiotherapy and radiation physics may well exceed the number of available fellowships. It is clearly desirable to assure the greatest efficiency in the fellowship programme, and it is therefore desirable that great care should be given to ensuring a wide geographical distribution of the candidates and to the difficult task of selecting the best recipients both on a national and international basis.

B—Visiting experts

These represent a very important form of assistance and must be encouraged. They must be integrated in a more general programme of international aid. Advanced countries and institutes should be urged to provide facilities for their staff to participate in such programmes.

There are two main categories of visiting experts. Long visits, i. e. of several months, will enable a broad new field of work to be initiated; short visits of experts will point to the direction in which a special effort is needed and will help the experts themselves to understand the problems of the centers visited and to guide the work of those who may subsequently receive fellowships.

C—Co-operation and exchange of personnel between institutes

Schemes of co-operation between individual institutes, either within a given country or in different countries, appear to be a particularly good way of providing training facilities on the one hand and unusual scientific or clinical material on the other. The working party draws attention to the possibility of the sponsoring organizations acting as intermediaries in arranging such co-operation. It is expected that the arrangements will include the exchange of professional and technical personnel between the two centers. It is suggested that such exchange should be arranged either as a follow-up to the visit of an expert from one center to the other, or in the course of a programme of co-operation between the two centers.

D—Training courses

The working party recognized that a formal training course, of some weeks' or months' duration and organized on a national, regional or international basis, can be of value, provided it is realized that a short course cannot replace the more lengthy training in a radiotherapy institute which is required to produce qualified radiotherapists and radiation physicists. Short courses may, however, perform a useful function in giving advanced training in certain fields to already qualified personnel.

E—Regional advisers

The working party agreed that the appointment of radiotherapists and radiation physicists as regional advisers would be valuable in many regions of the world. These advisers should be appointed on a long-term basis for the purpose of helping and advising all the radiotherapy centers within a defined geographical region. Such personnel should be carefully chosen, having regard to their technical and personal qualities.

F—Regional symposia

The working party considered that the holding of regional symposia should be encouraged. Such symposia, on both medical and physical aspects of radiotherapy, would be of benefit to all personnel in less-developed regions of the world and would foster co-operation in these areas.