The Egyptian cancer project

by C.B.G. Taylor*

Cancer is feared more than any other disease. It takes many forms, it may strike anywhere in the body, diagnosis is difficult, and treatment can be arduous. These are good reasons for fear, but they do not mean we are helpless before this disease. If it is treated early enough, it can be cured. In countries with good medical services there is general awareness of this, and much attention is given to cancer therapy. The situation is different in the developing countries, where few hospitals have the necessary equipment. Treatment may be given, but in too many cases it begins too late and can only control the course of the disease, with little hope of real cure. This is why the fear remains. Patients hesitate to come forward, and the chance of early diagnosis is low. Mortality among cancer sufferers in these countries remain at a very high level.

A group of specialists in radiotherapy from many countries met in New York in the summer of 1972 to consider this problem. They focused their attention on one form of the disease, cancer of the cervix (the neck of the womb) which in many countries is the most common form of cancer in women. There is a reliable and simple method of early detection for this condition, and for many years there has been an effective way of treating it, using radium. Could these techniques be adapted for much wider use, in countries with limited medical services? If so, what could a group of independent specialists do to help to bring this about?

Radium is a natural radioactive material found in association with uranium. To treat the disease small capsules containing radium are placed in precise positions inside and just below the uterus, so that the radiation has maximum effect on the cancer [1]. However, the highly penetrating radiation from radium is difficult to shield, so therapists and nursing staff are exposed to high levels of radiation. Radium is also very expensive. For these reasons this form of treatment has been falling out of use, being replaced by newer methods in which radiation is directed into the body from outside, using the artificial radioisotope cobalt-60 or sophisticated electrical machines. These methods do not expose the medical staff to radiation, but so far they have found little use in the developing countries. The cost of the equipment is too high and the technical problems of keeping it working are too severe.

The specialists who met in New York formed themselves into a Working Party [2] to study this problem and publicize their findings. Safer and cheaper alternatives to radium were becoming available, and were already in use in cancer hospitals in the developed countries, but details of the treatment were not widely understood and some important technical questions were still unanswered. The Working Party met regularly, every second year, in a different developing country. After each meeting an open conference was arranged in which local cancer specialists could join. By the end of the 1970s there was good agreement about the best line to follow. It remained to organize a demonstration scheme which would show how the recommended procedures could be applied in practice.

The IAEA and the World Health Organization (WHO) had been supporting the Working Party and taking part in its meetings. A small Task Force was formed jointly within these organizations and proposals for a pilot project were developed [3]. With generous financial assistance from the Italian Government, and the wholehearted support of the Egyptian Government, this scheme is now being put into effect in a group of hospitals in Cairo.

The method of treatment recommended by the Working Party replaces radium by radiation sources containing the artificial radioisotope caesium-137. These source are smaller, cheaper, and more intensely radioactive than sources containing radium. The main advance, however, is a new method of application which means it is no longer necessary for the radiotherapist to handle the radiation sources directly (and so be exposed to radiation) in order to get them into the proper positions in and around the cervix.

With the new technique a simple plastic "applicator" is placed in the uterus and the radiation sources are afterwards inserted into guide tubes which lead into this device. Each small source – about as big as a grain of rice – is mounted on the end of a flexible wire. Using this as a handle it takes only a few seconds to slip each source into the applicator. Three sources are used. With this "manual afterloading" technique the exposure of medical staff to radiation is reduced to an insignificant level.

Another advantage is that the radiotherapist who places the applicator in position is not under pressure to do the job quickly, since he is no longer worried about exposure to radiation, and so the positioning can be done

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very accurately. Before the sources are inserted the patient is X-rayed to check that the applicator is in exactly the right place. Only then she is moved into the room (an ordinary ward) where the radioactive sources will be passed through the guide tubes into the applicator.

Treatment takes about two weeks. The radiation is given in two courses of three days, separated by a break of one week during which the patient can go home. This division of the treatment is important. The timing is chosen so that the cancer cells are just recovering from the first dose of radiation when the second dose catches them in a particularly sensitive condition. Careful therapy of this type can completely destroy the cancer while causing little permanent damage to the healthy tissues in which it was growing.

As in all forms of radiotherapy it is necessary to adjust the dosage rather precisely, the aim being to deliver a dose within plus or minus five per cent of a predetermined value. This is set close to an upper limit beyond which serious damage might be done to important body structures close to the uterus. This limit is well known, from experience gained with radium, in many countries, over a period of almost half a century.

Such treatment, with small radiation sources placed close to the cancer, is known as "brachytherapy" (meaning treatment at close range), while treatment with beams of radiation from stronger sources located outside the body is "teletherapy". The afterloading method is an example of brachytherapy. It is effective against a small tumour which has not spread more than a few centimetres from the cervix, but it cannot deal with more advanced cases in which the tumour has spread far out into the abdomen. Teletherapy is then required as well. This requirement gave the Working Party much cause for concern, because of the complexity of the equipment required for teletherapy. This is also very expensive, costing more than ten times as much as a simple afterloading system, and needing in addition a special treatment room with thick concrete walls.

Unfortunately, it is especially in developing countries that patients come late for treatment and so need teletherapy as well as brachytherapy. Opinion in the Working Party was divided about how to deal with this: should brachytherapy be given alone until resources for teletherapy could be developed, or should the programme be delayed until teletherapy could also be provided? After much debate the conclusion was that brachytherapy, with afterloading, should be introduced without delay, and that particular attention should be given to the encouragement of earlier diagnosis. Facilities for teletherapy should be introduced later, as soon as possible, in at least one major hospital in each region.

With this formulation it was possible to plan a real-life programme, and the questions became where a pilot project should be set up and how it could be funded. Here the knowledge and experience of the Agency and WHO in organizing international projects played an essential rôle. Opinions were sought, and there was discussion with the Working Party. Dr Mahmoud Mahfouz, Professor of Radiation Therapy and Director of the cancer centre "NEMROCK" * of Cairo University Hospital, who had been an active member of the Working Party since its inception, offered to host the project in

Objectives of the Egyptian Cancer of the Cervix Project,
as summarized by H.E. Dr M. Sabri Zaki,
Egyptian Minister of Health,
in his address at the opening of the first Training Course of the Project, Cairo, 29 October 1983

"The objectives of this joint training project between the Kasr El Aini Centre of Radiation Oncology & Nuclear Medicine (NEMROCK), IAEA, and WHO, can be summarized as follows:

1. Early detection of cancer of the cervix, whether in specialized centres or by mass-screening.
2. Supplying NEMROCK, other University centres, and four Ministry hospitals with radiation sources and dosimetry equipment for the treatment of early cases, this being a good example of co-operation between universities and the Ministry of Health, for the good of the community.
3. The project entails setting up a registry for all cases as well as a follow-up system for patients treated, to assess the magnitude of the problem.
4. Training of radiotherapists, gynaecologists, medical radiation physicists, diagnostic radiologists, and cytologists, thus promoting a teamwork approach in cancer management under optimal conditions of radiation safety. It is envisaged that over four years 120 Egyptians, Sudanese, Africans, and Asians from the aforementioned disciplines will be trained through this project, to be followed by a permanent training programme, since technical facilities for this are now available.
5. This agreement will certainly allow NEMROCK to achieve a regional training institutional capability for radiation technology transfer in medical sciences. It pleases me to see that the technology of afterloading of isotopes is to be spread at the national and regional levels. Such a technique seems to be economically feasible and technically effective. I am also very glad that this exercise will solidify international scientific and technical aid between the Government of Egypt, the IAEA, and the Government of Italy.
6. Furthermore I am extremely happy to see that the socio-economic integration between Egypt and Sudan is moving forwards. The presence of Sudanese participants in this first training course is a landmark in the integration process between our two countries."

* "NEMROCK" is an acronym derived from the words "nuclear medicine and radiation oncology".

his institute. A detailed Project Proposal was prepared early in 1982 and put forward for funding as a "Footnote (a)" item in the Agency's Technical Co-operation programme. Its merits were recognized by the overseas aid department of the Italian Foreign Ministry, which also made valuable recommendations relating in particular to the component for early diagnosis. Funding for the revised project was quickly ensured by the Italian Government. An International Advisory Committee was formed and this met in Cairo early in 1983 to plan the first stages of the pilot project's implementation.

At this meeting Professor Mahfouz proposed an ingenious approach to the problem of early diagnosis. A campaign of general publicity would be too diffuse, and would over-strain the resources of the project. However, a group of general hospitals in the Cairo area was already referring difficult cancer patients to NEMROCK for treatment, and the gynaecological outpatient departments of these hospitals were regularly seeing a total of more than 60 000 patients each year. His proposal was to strengthen the cytological laboratories of these "associated" hospitals so that they could apply the test for early cervix cancer to this large pool of patients, and that the results of these tests should be passed to NEMROCK for recording and analysis.

The associated hospitals would also be designated as brachytherapy treatment centres under the project. Staff from each would be trained in the afterloading technique, and each hospital would be supplied with the radiation sources and other equipment necessary for treating early cases of cervix cancer. Advanced cases would be referred to NEMROCK, which already had the necessary cobalt-60 teletherapy machines.

Accepting these proposals, the Advisory Committee decided on the levels of equipment needed for the first stages of the project and planned a training course which would be given in the autumn of 1983, at NEMROCK. This was to last three weeks, and was designed for radiotherapists, gynaecologists, and medical physicists. It was hoped that a team with one specialist in each of these disciplines would attend from each of the associated hospitals.

Details of the course were worked out by the staff of NEMROCK during the summer. An important feature of this course, which had been suggested by the Advisory Committee, was a "common core" component in which the three disciplines would be instructed together, this being supplemented by separate sessions for each speciality. Practical demonstrations of the insertion and positioning of the plastic applicator were arranged during the latter part of the course. These were attended by the physicists as well as by the clinical specialists who would be carrying out the insertions in their own hospitals.

The course was carried out as planned. Its clinical lectures were given by staff from NEMROCK or other Egyptian hospitals. A visiting expert, provided by the IAEA, taught the physics component. Altogether 34 trainees attended this course. As well as teams from the associated hospitals in Cairo there were groups from three other hospitals in Egypt and one in the Sudan. A similar course will be held each autumn during the remaining three years of the project.

The language of the first course was English but if there is sufficient demand additional courses will be arranged in French.

The problem before the Advisory Committee now is to ensure that the momentum generated by the successful first course is not lost. Equipment has been ordered for those hospitals which are ready to begin regular treatment, and advice must be made available to them on the development of their new programmes. Much of this advice must come from NEMROCK, and this will mean an additional heavy burden on its already busy professional staff.

This draws attention to a general problem of development work, the demands it makes on the group of people who have made it their business to see that the project succeeds and continues to succeed. A few individuals can supply ideas, and money can buy equipment, but this is only the beginning. It has been suggested that the initiation of a project is only five per cent of the task: the really difficult part comes later.

In the case of the cervix project the efforts of the staff of NEMROCK, supported by advice and equipment from the Agency, have got the project started. For continuing success it must now become integrated into the day-to-day clinical and administrative routines of the associated Cairo hospitals, and then of district or University hospitals in other cities.

The component of the project which aims to achieve earlier diagnosis, based on wider application of the standard screening test ("PAP test"), will help to secure this integration. The Advisory Committee aims to provide not only the necessary laboratory equipment but also some extra technical staff, locally recruited and trained, to carry out the tests at each hospital. Some assistance with secretarial staff and equipment will be provided for NEMROCK, where the central register will be kept. It is hoped that by the end of the four-year project the value and feasibility of early diagnosis will have been demonstrated so clearly that it will be maintained by local funding. Early cases are not only easier to treat, they are also cheaper to treat than advanced cases.

In another form of "institutional strengthening" the project is upgrading the ability of NEMROCK to aid the physics departments of other hospitals taking part in the scheme. Radiation measuring equipment of high quality will help to make NEMROCK a centre of

excellence in this respect, and its computer facility will also be upgraded. The staff of NEMROCK are already expert in these fields but medical physics as a speciality is lacking in most district hospitals.

If these measures succeed, and the project is adjudged a success, it is probable that proposals will be received to duplicate it in other countries. Some African countries south of the Sahara, in which there are very few hospitals equipped for radiotherapy, could certainly benefit from schemes of this type. It will be evident from the above description, however, that straightforward replication of the Cairo project, based as it is on the situation in Egypt, will not be practicable elsewhere. The facilities already existing in each country, the degree of development of medical physics, the interests and experience of key medical personnel, must all be taken into account. Different approches will certainly be needed.

A closely related problem, which is relevant to the project but does not fall within its present scope, is the provision of equipment for teletherapy with radiation from the artificial radioisotope cobalt-60. This has been referred to above as a useful adjunct to brachytherapy of cervix cancer, but it is also much more than this. Cobalt teletherapy is one of the most widely used types of radiotherapy and is applicable to tumours in many other parts of the body.

The radiation source in a teletherapy machine is far more powerful than the small sources used in brachytherapy, several thousand curies compared to a few tens of millicuries, an increase in strength by a factor of 100 000 or more. Such a strong source must be kept in a massive "teletherapy head", a block of lead or some other heavy metal weighing a tonne or more, with a movable shutter section which allows a beam of radiation to leave the head in a controlled direction. The whole assembly is installed in a shielded treatment room, usually in the basement of the hospital. The shutter is operated by remote control from outside this room.

Such a telecobalt installation needs a reliable electrical supply, regular maintenance, and a new radiation source every three or four years. As new teletherapy equipment now costs upwards of US$ 250 000, and a replacement radiation source more than US$ 20 000, this is evidently something for only the largest hospitals. Its importance for cancer treatment is however so great that any serious programme must have access to at least one such installation.

It can be argued that teletherapy must be available in a region before brachytherapy can be introduced: the brachytherapy project in Egypt depends on telecobalt facilities at NEMROCK, for example. The Agency and WHO are studying this problem, encouraging manufacturers to produce simplified equipment suitable for use in developing countries, comparing the merits of new machines with those of reconditioned machines of proven design, and investigating the possibility of constructing treatment rooms with earth or sand for shielding instead of reinforced concrete. In all these problems there are questions in engineering and radiation physics which must be seen in the light of clinical requirements, and between them the two international agencies are well equipped to come up with effective answers.

In this they are ably assisted by the International Working Party, which will hold its next meeting in January 1985, in Bangkok. Scientists and clinicians with a professional interest in the objectives of the Working Party are welcome to attend its meetings. For details they should write to one of its Co-chairmen [2].

References

[1] *"Radioisotopes for the treatment of cancer in developing countries"*, **C.B.G. Taylor,** IAEA Bulletin Vol. 25, No. 2, June 1983.

[2] *International Working Party for the Treatment of Cancer of the Uterus in Developing Areas using Radium Substitutes and Afterloading Techniques.* Joint Chairmen: **Dr. M. Snelling,** Radiotherapy Department, Middlesex Hospital, London; and **Dr. N. Simon,** Radiotherapy Department, Mount Sinai Hospital, New York.

[3] *"Treatment of Cancer of the Uterus in Developing Countries: Proposals for a Programme"*, **C.B.G. Taylor,** IAEA Report IAEA/RL/92, November 1981.