

REDUCING DANGERS OF INFECTION

Radiation has given medical workers a new way of increasing safety when carrying out both major and minor operations. Work in using it to sterilize instruments, materials and tissues was discussed by scientists from 27 countries at a symposium held in Budapest early in June. They also received recommendations on a code of practice drawn up by experts appointed by the Agency, the first attempt ever made to obtain standardization of medical sterilization methods.

With the advent of radiation has come the disposable syringe. When it is taken out of its wrapping, used and thrown away, doctor and patient alike have confidence in its absolute cleanliness. Other medical instruments and appliances, including dressings and bandages, can be given the highest degree of freedom from harmful germs and bacteria by being subjected to radiation at carefully gauged strengths without themselves being made radioactive. Now the method has been extended to animal and human tissues, including bone, used for grafting into the body, and advanced experiments are taking place to ascertain whether vaccines and solutions for injection can be treated in the same way.

One advantage of using radiation is that it is a cold treatment, as opposed say to heat sterilization, and can be carried out after packaging. As a result, new materials such as plastics are now being used for manufacture and packaging and there are indications that these also help from a hygienic point of view since they do not seem to harbour bacteria readily.

The Budapest symposium, on radiosterilization of medical products, was the first the Agency has held in Hungary. The choice was fitting, because Hungarian scientists have been studying the subject for many years, and it was at the suggestion of the Hungarian Government that an Agency programme of international collaboration is in progress. World interest has grown rapidly, as shown by the attendance of more than 150 drawn from 27 countries and three international organizations, as well as by the keen discussions on each of the five days.

Dr. B.Toth, Deputy Minister of Health in the Hungarian Government, described radiosterilization as one of the most useful ways of using atomic energy for peaceful purposes and to the advantage of mankind.

Dr. Henry Seligman, Deputy Director of the IAEA for Research and Laboratories, said that this was one of the subjects in atomic energy which was not for the "long-haired scientist" but of great practical use, a fact which made it welcome to see the number of developing countries taking part in the work. The symposium was the result of a number of meetings of experts over the past two years. One of the important efforts had been to prepare recommendations for an international code of practice. Collaboration had been not only between nations but between many different branches of science. The Agency proposed to continue to promote research by contracts and agreements, to help to increase the numbers of qualified people by training methods, and to publish a handbook dealing with the new technology.

One of the pioneers of radiosterilization, Professor S.A. Goldblith, USA, surveyed the present state of knowledge, dealing particularly with the effects of radiation on bacteria. He related the medical work to similar studies in food sterilization. There were many aspects calling for further research to determine the ways in which the nuclear method could supplement traditional techniques such as heat and gases. Great developments had taken place in an atmosphere which had shown that science could be a unifying force.

BONE AND HEART OPERATIONS

The efficiency of radiosterilization with bone has led to the establishment of "bone banks" in Poland and Austria to serve wide areas. Pieces of bone can be packaged, sterilized and kept for long periods at normal room temperatures, with the result that human instead of animal bone can be used for replacement purposes in human beings. K.Ostrowski, Poland, reported that 6000 specimens to be used for grafting into bodies had been irradiated in the bone and tissue bank of the Warsaw School of Medicine, and all were sterile when tested for bacteria. All other tissues sterilized by gamma irradiation, including human cartilage, had proved to be of value clinically, and no complications which could be related to the method had been observed.

In heart operations some conditions call for replacement urgently of valves. J.R.P.Gibbons, UK, stated that in a London hospital valves had been sterilized with gamma radiation. Aortic valves replaced in two patients had been working normally for more than a year. No patients had needed therapy to prevent coagulation and there had been no evidence of embolic complications or blood poisoning. It was now possible to carry out the operation immediately and the surgeon could be confident that the replacement was sterile. The same speaker had used artificial valves consisting of solid silicone balls in metal cages. For these it was essential to have a sterilization method which did not affect valve efficiency. He had found that a radiation of 2.5 megarads (2.5 million radiation dose units) guaranteed sterility. Valves treated in this way had been inserted in forty patients during the past two and a half years. Twelve of them had been observed for eighteen months after the operations and there had been

no evidence of any infection or malfunction. For artificial tubing which sometimes had to be used in hearts a great deal of time and effort had been saved, and it had been found that the packs of tubing could be kept indefinitely.

VACCINE RESEARCH IN USSR

Extremely detailed experiments have been performed in the Gamaleya Institute for Epidemiology and Microbiology, Moscow, on the effects of radiation on medical products and vaccines. M.A.Tumanian, USSR, recounted the results of the work, which had been related to bone transplants, artificial vessels, material for sutures, and plastic articles. She had also been engaged in producing vaccines against intestinal infections by using the ability of ionizing radiations to kill micro-organisms. Use of gamma rays on vaccines used against dysentery and typhoid did not affect the properties, but the same could not be said for vaccines produced by normal means.

L. Lopez de Alva, Mexico, noted that in sterilizing human blood plasma, the use of ultra-violet rays and of beta propiolactone had not been satisfactory. Experiments with radiosterilization had been successful, as well as indicating that the process was simple and practical.

Evidence that certain infective germs do not like plastic materials came in measurements made in Hungary and UK of the contamination of plastic syringes before sterilization. In each case the syringes were deliberately kept in normally unsanitary conditions, and even after long periods contamination was found to be low. It thus appeared that the radiation work had encouraged the development of materials useful from a medical point of view. An incidental point noted by R.J.Berry, UK, was that fungal contamination appeared to be seasonal, with the highest incidence in April and May. This is to be the subject of another study.

J. Holland, IAEA, gave details of research on antibiotics known as tetracyclines to indicate that radiosterilization in the dry state may be practicable. Another IAEA project outlined by F. Antoni had given promising results with blood plasma.

A number of research programmes in Hungary were described. E.Pandula said that at the Pharmaceutical Institute of the Budapest Medical University atropine sulphate, morphine and procain used for injections had been examined. Each was sensitive to heat, so that the new method had important possibilities, and it appeared that there might be ways of making irradiation effective. At the Gedeon Richter Chemical Works, thyroid extracts had been the subject of experiments to find the best ways of reducing contamination. G. Hangay considered the prospects favourable. J.Gergely, of the Budapest National Blood Centre, had found varied results with the protein immunoglobulin G, valuable because of its resistance to measles, polio and other diseases.

As a result of comparison of different methods of sterilization of catgut, used for medical stitching, S.J.Lengyel (Hungary) and others drew the conclusion that the radiation process had advantages in that it could be performed after packaging, that healing of the tissues was quicker, that the tensile strength of the suture was remarkably increased, that operating theatre work was reduced, and that the same radiation source could be used to treat other surgical materials.

DRUGS AND OINTMENTS

There was considerable discussion on the suitability of certain pharmaceutical preparations for the process and of the care being taken to discover whether they can be adversely affected. G.Hortobagyi (Hungary) and others had examined seven materials after irradiating them at 2.5 megarads. Two of them showed no physical or chemical changes and only one of them, hydrocortisone, any measurable decomposition. G.Hangay (Hungary) had chosen hydrocortisone eye ointment for investigation because it did not lend itself to conventional methods of sterilization. From the physical and chemical aspects radiation appeared favourable and realisable. Bacteriologically, according to M.Haraszti (Hungary), further experiments were necessary to establish the correct radiation dose.

A.J.Ogg (UK) was positive on the subject of eye saline. He recalled that after the sight of fifteen eyes had been lost at an English eye hospital from infected saline it had been advocated that the material should ideally be packed, sterilized, stored and utilized in one container. Only last year such an ideal was considered impossible to achieve. "With gamma ray sterilization" declared Ogg "this now presents no particular problem". For injections a routine method had been established at Salisbury Infirmary using a packed syringe sterilized by irradiation. After two years no untoward effects had occurred, and he had no hesitation in saying that it was by far the safest method. He had never been able to show any harmful effect in normal or diseased eyes after the use of any irradiated medicament. He condemned certain methods in present use and thought that the single pack technique could serve to include articles such as swabs and eye pads.

CODE OF PRACTICE

The recommended code of practice presented at the end of the symposium covered not only the use of radiation but all manufacturing processes. It had been prepared by a working party of experts after studies by IAEA panels in which international practice had steadily increased during the last two years.

Reviewing the recommendations, L.O.Kallings, Sweden, considered the timing to be appropriate. It should be of great assistance to countries which had not yet prepared legislation regulating the use of radiosterilized medical

products. It was often tragically true that science was brought to bear on a subject only after damage had been caused, and there had never previously been an attempt to standardize heat methods despite the length of time they had been in use. The ethylene oxide process undoubtedly needed a code of practice. Foresight in this case had been due to the existence of an active and efficient international organization. The World Health Organization and the European Nuclear Energy Agency had both participated.

Kallings put the necessity for wide safety margins first in the general principles established. More laboratory resources could be put to checking the manufacturing processes, say, of syringes. Safety margins should be such that there would be little point in making tests after sterilization. The code contained measures to minimize contamination at all stages of manufacture and packing. It also recommended a graded system of radiation doses according to the product or material. Microbiological standard preparations would be made available by the Agency for testing efficiency. There would also be checks of efficiency of radiation by using it on articles already deliberately contaminated. Irradiation plants should be strictly controlled by appropriate national authorities.

He thought that application of the code and its acceptance between States would be valuable for hospitals and could benefit all industrially produced sterile materials, facilitate trade and promote greater use of modern methods in medicine.

K.O.Wallen (WHO) said that the code would be closely studied, especially in the light of a programme concerning good manufacturing practice in pharmaceutical quality control initiated by WHO.

E.T.Connybeare (UK) considered that the Agency's "brainchild" formed a good basis for advice.