

## Atoms for health: A need in Asia

by Ramendra Mukherjee

A major category of health disorder involves tissue injury caused by traumatic accidents, congenital deformities, and degenerative diseases, among others. Remedy for such morbidity conditions often requires replacement of the injured or defective tissue by corresponding healthy tissue through reconstructive surgery. Conventionally, surgeons successfully have used a patient's own healthy tissue (autogenous tissue graft) as and when practicable.

Despite therapeutic success with this method, it is considered one of limited value. The patient may be doubly operated, once for procurement of normal healthy tissue and again for application of those tissue grafts in corrective surgery of the diseased region. The associated suffering, health risk, prolonged hospitalization, and surgeon's time are all factors indicating against this option. Furthermore, the approach's applicability is heavily dependent upon availability of spare healthy tissues from the patient's own body in the required quantity, shape, and other details.

Such problems have led surgeons in various disciplines to explore the use of tissue grafts from exogenous sources in reconstructive surgery. Experimental studies and clinical trials, mainly carried out in North America and Europe, have established the utility of duly processed and preserved non-viable "tissues" from other members of the same species (known as allograft), and even in some cases tissues from different large mammalian species (known as xenograft).

Suitable methods of hygienic procurement have followed for bone, skin, dura mater, fascia lata, cartilage, tendon, peripheral nerve, heart valve, and artery from a donor human cadaver. Bone tissue from a calf and skin dressings from a pig have met with successful clinical applications on human patients.

### Radiation for tissue preparation

Relatively recently, encouraging experiences have been recorded from the use of ionizing radiation for sterilization and preparation of tissue grafts.

Tissue banks and surgical units in Europe and North America have shown that ionizing radiations, such as

gamma radiation from a Cobalt-60 source, when applied correctly can be a safe and reliable method of sterilizing human tissues for transplantation.

This new field of beneficial nuclear applications in health care owes its successful development to radiation sterilization practices for medical supplies. The problem of toxic residues remaining on medical supplies and tissue grafts after chemical sterilization often has raised concern over health risks, particularly as grafts are expected to come in direct contact with the recipient's body fluids. Thus, more and more attention is being directed towards possible uses of radiation for tissue graft processing.

Penetrating radiation sterilizes pre-packed hermetically sealed tissue grafts, just as it sterilizes packaged medical supplies. For bulky tissues, such as bone, radiation has proved to be the most effective sterilizing agent. Furthermore, radiation helps to reduce the antigenicity of human tissue grafts and so provides an added bonus from its application.

### The practice and problems in Asia and the Pacific

The IAEA recently held a seminar at the Philippine Atomic Energy Commission in Quezon City (near Manila) to promote dissemination of current technical information on this potential field of beneficial nuclear applications and to co-ordinate with regional surgeons and other health authorities.\* Thirty-four scientists and medical professionals representing eight Member States (Bangladesh, India, Pakistan, Philippines, Sri Lanka, Thailand, United Kingdom, and the United States) attended.

In Asia and Pacific regions, reconstructive surgery is an aspect of health care nearly totally neglected, primarily due to non-availability of tissue grafts, participants reported.

Surgeons in all these Member States have the necessary expertise. Nevertheless, their "rudimentary experience" in the field is solely attributable to the fact they may only rarely implement, if at all, the health-care practice as and when a patient can afford to provide necessary grafts. Patients must purchase them from

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\* The seminar was officially entitled "Seminar on Tissue Banking of Radiation Sterilized Grafts for Clinical Use for Asia and the Pacific" and held 7-11 May 1984.

commercially available sources. Concomitantly, a vast indigenous source of cadaveric tissues are wasted, since there are available neither practices for procurement or preservation nor necessary facilities and tissue banks.

Illustrating the extent of the problem, the Burns Plastic Centre of the Philippine General Hospital reported an estimated annual survey of over 5000 traumatic accident cases where victims had suffered burns over 30 to 80% of their bodies. For temporary replenishment of damaged "skin-surface properties" in these patients, appropriate sterile dressings are needed. Radiation sterilized skin dressings (such as pig skin) are commercially available, but at a high financial cost. On average, with four to five changes of such dressings for a patient burned over 50% of the body, the cost of sterilized skin dressings could be as high as US \$350 to \$400. Too few of these patients can afford such a price.

Compromise attempts, using unsuitable therapeutic alternates, often result in high fatality. Similar situations are repeated with bone grafts, heart valves, arterial conduits, dura, and fascia. Skeletal losses leading to "bone cysts" from tubercular and neoplastic diseases, as well as bone fractures, demand processed bone grafts. Indigenous capability to process such grafts will promote health care services and should be encouraged.

### **An answer: a tissue bank**

One participant, from Sri Lanka, reported on the remarkable achievements made by the Eye Bank, which in this author's opinion could be elevated into a "multi-tissue bank" for the region.

Promotion of eye donation after death among the Sri Lankan population has resulted in a plentiful cornea supply for clinical use in grafting and the campaign for prevention of blindness. Besides meeting domestic needs, the Eye Bank in Sri Lanka has supplied surplus eyes to many other countries for clinical applications. To date, the Eye Bank has provided 14 118 eyes to patients in 117 cities in 45 countries, including Sri Lanka.

With the possible provision of additional facilities and a radiation source, all other relevant tissues from the donor cadaver could henceforth be procured and processed by the Eye Bank, thus creating a "multi-tissue bank." Such a tissue bank would continue to co-operate and serve health care in the region, as it has done so far with regard to corneal grafts.

The IAEA already has successfully implemented a tissue bank in Rangoon, Burma, under its Technical Co-operation programme, and that effort was reviewed at the seminar by IAEA's expert for that project. The status of clinical applications of radiation-sterilized tissue grafts, and follow-up studies of patients, were reviewed in detail in the context of evaluation of needs, operational experiences, and future prospects for tissue banking in the region.

### **Awareness, confidence stimulated**

The seminar fulfilled its objectives by stimulating awareness among national health care authorities in developing Member States regarding the importance of introducing indigenous tissue sterilization practices and banking facilities.

Presentations by tissue-banking experts from Europe and North America, along with the support of video films and exhibits, helped participants from Asian regions regain confidence in their ability to locally implement the practice.

Repeatedly revealed in discussions was that tissue-graft processing and sterilization does *not* involve a "high technology." The rational deployment of existing inventory of equipment, expertise in the leading health centres, and newly introduced practices for radiation sterilization of medical supplies in most Member States of the region (under IAEA programme activities) should help in laying the foundation for tissue banking.

Scientific contact with some leading experts helped initiate effective collaboration channels, including access to relevant literature and technical protocols. The experts further undertook demonstrations on tissue-graft handling for safe clinical use and provided valuable tips for exercising caution. The illustrious examples and experiences from Fellow Member States of the region provided encouragement to overcome any difficulties encountered from socio-economic or religious grounds.

Finally, the seminar strengthened regional co-operation among Member States to implement improvements in health care through development of suitable nuclear techniques for tissue-graft sterilization and tissue banking. The framework of an IAEA co-ordinated research programme on the topic was worked out to promote generation of necessary new scientific and technical data pertinent to specific local needs for the practice's development, including criteria and guidelines.

