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The International Atomic Energy Agency (IAEA) Research on Radiation Sterilization in Tissue Banking

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IAEA program on radiation and tissue banking is a major effort to establish and improve tissue banks in Member States (MS). It was originated in 1971 and became supported by IAEA's Department of Technical co-operation in 1982. Until now, there are a number of running projects in this area coordinated by the Agency. Less known is that, apart from capacity building by the TC, IAEA's Department of Nuclear Sciences and Applications carried out Adaptive Research and Development projects related to tissue sterilisation. These two directions of work reinforce each other and result in better Tissue Banking services in MSs.

IAEA Coordinated Research Project (CRP) E31006 on "Safety and optimisation of radiation sterilization in tissue banking: Studies on functional properties of irradiated tissue grafts" was started in 2010 and completed in 2015.

16 organisations, represented by Chief Scientific Investigators: Paulina Maria Estela Aguirre Herrera (CHI), Dr Emma Castro Gamero (PER), Mark Forwood (AUS), Clara Linda Guerrero (COL), Marisa Herson (AUS), Eulogia Kairiyama (ARG), Artur Marek Kaminski (POL), Astrid Ann Lobo Gajwala (IND), Jan Koller (SLO), Menkher Manjas (INS), Monica Beatriz Mathor and Wilson Aparecido Calvo (BRA), Peter Myint (UK), Isabel Maria Otero Abreu (CUB), María del Carmen Salidas Farinella (URU), Suzina Sheikh Ab. Hamid (MAL), Sven Scheffler (GFR) contributed to this project.

The use of tissue allografts in surgical procedures has increased tremendously over the last two decades. Radiation has been used to sterilize tissue allografts on a large scale. Controversies exist regarding the optimal dosage required since radiation may also compromise tissue allograft integrity and/or its biological function. Tissue banks use radiation doses just based on empirical and/or historical data, or use a fixed dose of 15 or 25 kGy for all tissue allografts. Moreover, radiation conditions differ very strongly from institute to institute which may strongly influence the efficacy of the radiation treatment. In order to improve the knowledge on radiosterilization of tissue allografts "new" and additional studies were designed and conducted under controlled and validated conditions. This "new knowledge" will lead to an optimization of the radiation sterilization process/procedures.

Five main categories of research topics were studied: Bone, Demineralized bone, Cartilage allograft, Skin and Amnion.

Bone: Adoption of sterilization doses below 15 kGy improves tissue quality and surgical outcomes. Demineralized bone (DMB): Sufficient Osteo-induction was observed after experiments using DBM treated at 15 kGy radiation dose. **Cartilage:** The present studies demonstrated that Optical Coherence Tomography (OCT) is a suitable non-destructive technique to evaluate the changes in costal cartilage after sterilisation by ionizing radiation. **Skin:** Most sensitive tissue to structural changes induced by radiation proved to be animal skin, least sensitive human skin. Irradiation dose up to 25kGy had minor impact on the ultrastructure of the irradiated skin and its functionality (evaporation index).

It can be concluded that since 2010 significant progress has been made by the participating tissue banks/institutes leading to the production of safer allografts both with respect to its functionality and sterility.

Country/Organization invited to participate

International Atomic Energy Agency

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