MOLULAR IMAGING UNIT OF LARGE ANIMALS

ORGANIZATION

The development of the imaging techniques mentioned above (PET, CT) implies the handling of non-sealed radioactive isotopes and the use of equipment emitting ionizing radiation (X-ray), which is why, according to the Spanish legislation, it is necessary to have a radioactive facility (RF) authorized by the competent authorities.

Central Laboratory of Radioisotopes PET. Designed for the manipulation of high activities or high-risk isotopes (radioactive iodine, high-energy gamma). It is also used for the management and control of the RF and contains the central radioactive waste deposits.

Molecular Imaging Unit (MIU). Specialized Unit in molecular imaging. This unit will be in charge of the preparation of the doses, administration to the animals, and their obtaining the images analysis. This unit is part of the Animal Facility.

HANDLING OF LARGE ANIMALS

The animal model that is going to be used principally in the MIU is the pig. Due to the fact that the CNIC has been working with porcine models for several years, it is logical that the animal model that is going to be used in the MIU is the same. The animal will be kept in isolated cages inside the animal facility. The operator will realize an anesthesia with intravenous injection able to realize the manipulation of the animal under safety conditions. A surgical scaling will be realized for continuous withdrawal of urine, in order that this way, once incorporated the radiopharmaceutical, the contained contaminations will be eliminated in a shielded container avoiding the risk of contaminations. Once prepared, the pig will be transported in a stretcher adapted up to the zone of injection of isotopes next to imaging room. Finished the image acquisition, the pig still marked with the radiopharmaceutical, but after incorporation and image acquisition times, will be transported as cells different from the original ones. These cells will be placed in an independent large room conveniently shielded. Once passed the period of decay of the radiopharmaceutical, the animal will be transported to its conventional cage and there will be realized the radiological examination.

EQUIPMENT

Imaging Area:
- Imaging equipment: PET/CT and PET/CT.
- Addressing table.
- Shielded screen.
- Manipulation of the sedated animal.

Central PET lab area:
- Manipulation cell.
- Dose dispensing system.
- Activimeter.
- Shielded carrying box for internal dose transport.
- Trolley for internal dose transport.
- Radiation and contamination Monitor.
- Wastebaskets or furnishings for temporary waste storage.

Lairage Area for injected animals:
- Induction cell.
- Containers for the liquid wastes of the animals.
- Shielded screen for the protection of the personnel.

PERSONNEL AND DOSIMETRY

The personnel involved in the handling of PET isotopes and radiation emitting equipment is as follows:

- Personnel in charge of Radiation Protection management: Made up of the Responsible of the RF and a team of assigned technicians. These personnel will be in charge of the reception and registration of the commercial radioactive material and the operations of storing and control of the RF.
- Molecular Imaging Unit: Made up of a Person in charge holding a Supervisor license and a team of technicians with operator licenses. These personnel will be in charge of the development of the different imaging techniques.
- Research Personnel: They will carry out the techniques of labeling experimental tracers with PET isotopes.

Doseimetry of occupationally exposed personnel of Category A and B must be done by means of individual dosimeters. In our case, we use thermoluminescent dosimeters. The whole body dose must be controlled during the entire working day by means of lapel dosimeters. For the personnel who directly handle the radioactive isotopes, the hand dose must also be controlled by means of ring dosimeters. After an accident an additional control by means of internal dosimetry must be done.

CONCLUSIONS

The research in cardiovascular image in big animals joins in an alone imaging device two promising technologies of image that even had not been achieved to join still. It is the fusion of PET and MR. A question of the merger of the PET and of the RM. The RM does not issue radiations since there do the devices that use X-rays. It is logical, therefore, that the combination of both gives new capacities to radiation dosimeters and, in the future, to these dosimeters, it will be necessary to have an adaptation algorithm in order to measure the doses applied to human beings.

The previous cold training, as well as the selection of personnel are vital actions to reach the target of the safe use of these isotopes and to support the low doses.

REFERENCES


MOLULAR IMAGING TECHNIQUES

Molecular imaging techniques have become important tools for the clinical diagnosis of several diseases. These techniques are today in a highly mature state in the clinical field and are now being rapidly developed for use in biomedical (preclinical) research.

Among currently available techniques are those allowing acquisition of high resolution anatomical images (CT, MR), while others offer unique opportunities for the localization of molecular imaging (PET, SPECT, optical). However, used separately each technique offers limited information, and therefore the emphasis of imaging applications for research is on multimodal imaging, wherein images from different techniques are combined to yield an image of high resolution and sensitivity.

MOLECULAR IMAGING UNIT OF LARGE ANIMALS

DESIGN IMAGING UNIT

WORK NORMS AND TRAINING

For working with PET/PECT isotopes and the radiation emitting apparatus, the general norms for working with radioisotopes apply. These include norms regarding the operator: personal protection (gloves, lab coat, etc.), dosimetry, use of personal protective equipment, and correct use of the dosimeter, norms regarding the work area: symping, order and cleanliness, containment, monitoring, access control, etc., and norms regarding the surroundings: contamination and radiation monitoring and correct waste management.

The personnel should be trained in specific aspects as handling of PET/PECT isotopes, handling of animals, and emergency response.

WASTE MANAGEMENT

The radioactive waste of PET isotopes generated due to the accomplishment of planned works carried out, to incidents (including animal death caused by handling radioactive animals, etc.) and the cleanliness of material and areas of work.

- The solid residues and liquids produced will be stored in the own containers of withdrawal (bottles of polypropylene in shielded container, shielded bin, etc) and stored in a location prearranged of the laboratory up to its decay (normally between 24 and 48 hours).

- The counting material and the hypodermic needles used for the injection of radionuclides, they will settle in approved standard containers. These containers will be shielded by another container up to his decay.

- In the laboratory rooms destined to marked animals, there is a system adapted for the containment of urines and contaminated accommodations. Effluent will remain confined up to his total decay, later be evacuated to the network of sewer by means of a remote operator controlled evacuation valve system.

BIOSAFETY

In the MIU, it is necessary to contemplate the tests that combine with the inoculation of microorganisms of the Risk Group 2, or it is possible the situation where an animal is infected by some microorganism and this of natural form could supposed some risk of transmission to the scientific staff and to the personnel in charge of the animal care area. Biosafety’s procedures that are destined to reduce these risks:

- Sensitation of surfaces and materials with germicides.

- The remains of carcass of the animal and his affluent ones are gathered in approved, closed containers. The generated containers are processed by autoclave in the own installation and later they are withdrawn by a managing authorized company which will incinerate.

- In case of big animals marked with radioisotopes and inoculated with micro-organisms of from risk group 2, who die during a study or are sacrificed, follows a specific procedure of waste management and disinfection.

- Effluent will remain contained up to the moment of his total decay, later be evacuated to the network of sewer by means of a remote operator controlled evacuation valve system.