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Concluding Plenary Session III

MEDICINE

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TS III.3.1
Radiation Protection in Diagnostic Radiology

Part I. Conventional Radiology

Part II. Computed Tomography

TS III.3.1 Diagnostic Radiology
Main topics

- Quality Control
  - Measurement: Methods, analysis, devices
  - Phantoms and software development
  - Monte Carlo simulation on voxel phantoms
- Dose audits: local, national, regional levels:
  - Large variations
  - Mean doses largely fall within International reference doses
  - Paediatric CT doses in some cases similar to adult doses
- Proposals for establishment of DRLs: adult and children
- Image quality: methods for analysis and audit
- Technology Changes
  - Faster film-screen (FS) combination
  - Computed radiography (CR)
  - Direct digital radiography (DDR)/flat panel
  - CT fluoroscopy

TS III.3.1 Diagnostic Radiology Conclusions

1. Dose evaluation and DRLs are effective optimization tools
2. It is important to evaluate Image Quality (IQ) and establish optimized dose-IQ relationship
3. The sequence survey-training-resurvey can be used as a model of optimization
4. There is need to develop optimized scan protocols for paediatric patients
5. Use DLP instead of tube loading for CT shielding calculation
6. Use of voxel phantoms for dose evaluation where available

TS III.3.2

Radiation Protection in Interventional Radiology

TS III.3.2 Interventional Radiology
Main topics

- Staff Dosimetry
- Patient Dosimetry
- Technical issues

TS III.3.2 Interventional Radiology

- Occupational
  - No regulation or harmonization of use double dosimetry.
  - Real time dosimeters can be useful
  - There is need to carry out dose assessments at different parts of the body such extremity doses, especially fingers, knees and gonads.
  - There is still lack of use of lead aprons by some personnel and of regular checking of its quality

- Patient doses
  - Reference levels should be established where possible and regular dose assessments should be made.
  - Pediatric levels are still needed.
  - Adult dose settings should not be used for pediatrics
  - Use criteria for advance identification of high skin doses

TS III.3.2 Interventional Radiology

- Technical Issues
  - Flat plate detector led to higher doses
  - ECG modulation can be useful in DSA/CTA
  - Grid controlled fluoroscopy was found to provide no significant dose saving

TS III.3.2 Interventional Radiology Conclusions (I)

- Today IR is safe and highly beneficial to patients, but the levels of radiation are among the highest used in medical imaging. ICRP recommendations should be followed.
- Medical doctors employing fluoroscopically-guided procedures need to be trained and certified in RP for this practice.
- X-ray systems used for IR should be submitted to a strict acceptance and commissioning process.

TS III.3.2 Interventional Radiology Conclusions (II)

- Industry should continue to implement dose saving options for interventional systems and improve standardization and archiving dosimetry data.
- Occupational dosimetry should be improved.
- Patient dose surveys and the use of reference levels should be extended, including paediatrics.

Session II.3.3

Radiation Protection in Nuclear Medicine

Session II.3.3 RP in Nuclear Medicine
Thematic areas

- Dosimetric Aspects
  - Exposure rates and individual doses
  - Internal dose to personnel
  - Internal dose to patients
  - Dose to caregivers
  - Cellular dosimetry
- Optimization of activity and image quality
- Quality assurance
  - Software validation
  - Quality control measurements
- Computer modeling
  - Anthropomorphic and voxel phantoms
  - Beta radiation fields
- Overviews
  - Nuclear medicine centers
  - PET / cyclotrons

Session II.3.3 RP in Nuclear Medicine Conclusions

- Growing emphasis on RP in nuclear medicine
- There is a variety of ongoing research activities
- Importance of short-lived radionuclides for PET
- Increasing emphasis on quality assurance (dose calculation, imaging equipment, etc.)
- Prospective facility and process planning allow for optimization of patient and public doses
- Intercomparisons of treatment regimens and equipment help for setting facility- constraints
- Increased accuracy and new reliable data can be obtained from real-time studies
- Further research by real-time measurements on equivalent doses to extremities is warranted

III.3.4
Radiation Protection in Radiotherapy

III.3.4 Radiation Protection in Radiotherapy Thematic areas

- optimization in treatment planning
- beam calibration and characterization
- radiation shielding
- radiotherapy technology
- treatment delivery and verification
- proactive safety assessment

III.3.4 Radiation Protection in Radiotherapy

- Several Monte Carlo simulations of dose distributions and special new phantoms for QC of complex treatments
- Comparison of different methods for determination of absorbed dose to water in reference and no reference conditions, including the use of different ion chambers and other detectors, the development of ad hoc algorithms, and postal audits.
- Specific methods for validation of dose verification or for estimation of patient doses and distribution in common treatment situations
- Occupational exposure was estimated in several types of facilities including proton and heavy particle radiotherapy facilities. Estimation of neutron doses and instruments for neutron measurements were also presented.
- Evaluation of compliance with appropriate manufacturing standards of different equipments.
- A proactive safety assessment (PSA) to avoid accidental exposures for treatment with accelerators was proposed

III.3.4
Radiation Protection in Radiotherapy
Conclusions

- New highly conformational RT demands new challenges such as dose escalation, reduced margins, steep gradients or high accuracy in terms of dose calculation, delivering and verification.
- Tools such as inverse planning or Monte Carlo simulations are needed for those techniques to validate its safety.
- Since radiation therapy is the practice where the radiation dose intentionally applied to human beings is the highest, the application of the requirements for QA must be more exigent to assure radiation safety.

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General conclusions

- New and rapidly evolving technologies raise new issues
- The implementation of QA programs is essential to assure radiation safety
- Qualified personnel is needed
- Health professionals needs to be properly and regularly trained in radiation protection
- Implementation of appropriate regulations
- Health authorities and medical professionals societies participation in the regulation of medical exposures
- Harmonization and better coordination among multiple stakeholders

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- **Implementation of appropriate regulations**
- **Health authorities and medical professionals societies participation in the regulation of medical exposures**
- **Regulatory Body may mean more than one body each having different responsibilities**
- **Closer relationship between the Regulatory Body and Health Authorities**
- **Harmonization and better coordination among multiple stakeholders**

MUCHAS GRACIAS

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