Summary of Contributed Papers

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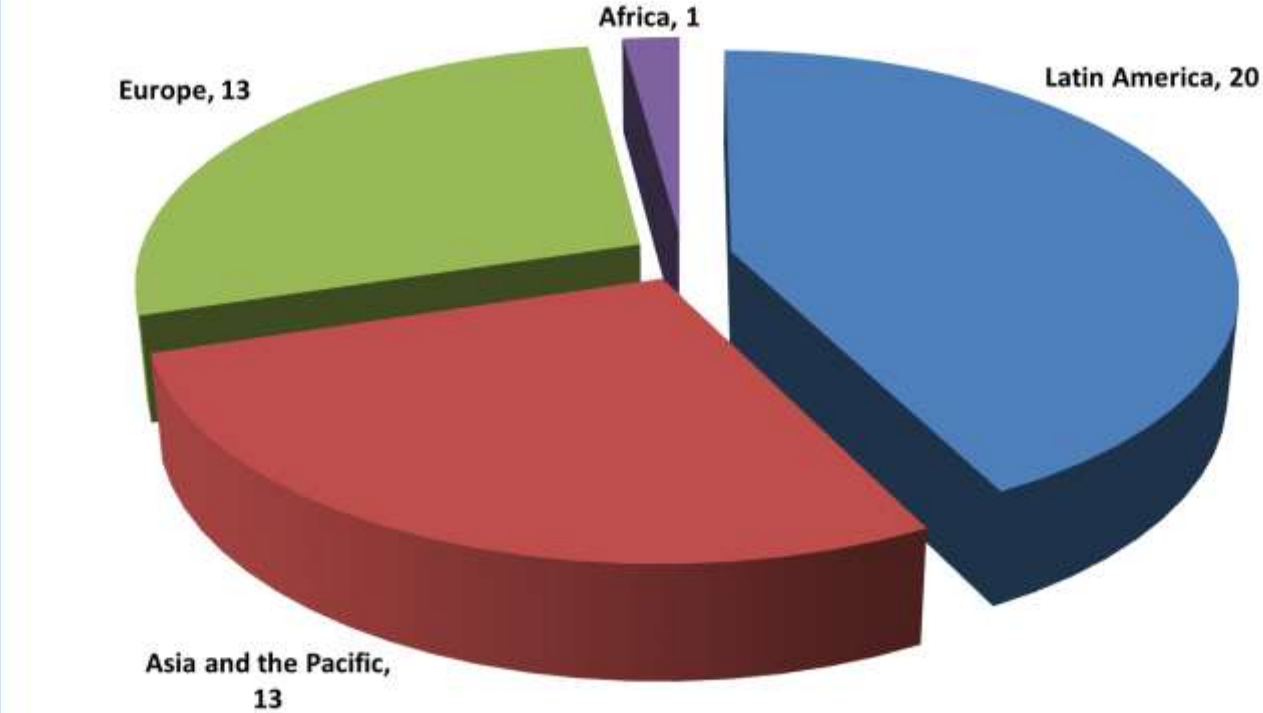
IAEA
International Atomic Energy Agency

Overview

- 47 full contributed papers on **radiation protection in radiotherapy**
- More contributed papers than any other session
- 43% received from Latin America



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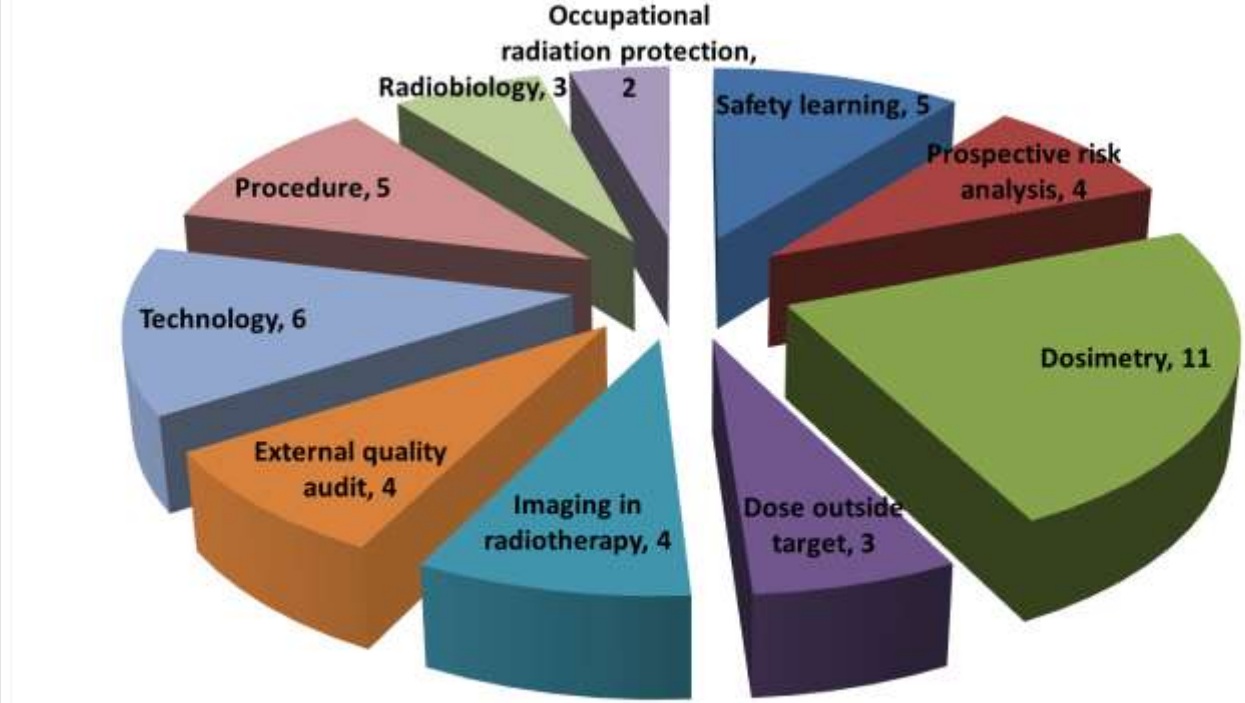
Overview

- 10 main themes in contributed papers
- All available in full on USB-stick
- Some examples highlighted here



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Prospective risk analysis 1

C. DUMÉNIGO (Cuba) et al. - APPLICATION OF THE RISK MATRIX APPROACH IN RADIOTHERAPY: AN IBERO-AMERICAN EXPERIENCE

- Ibero-American Forum of Radiological and Nuclear Regulators (FORO) has applied risk-matrix methodology for Co-60, linear accelerators and brachytherapy
- Main defences (interlocks, alarms and procedures) that could prevent, detect, monitor and mitigate potential accidents were identified

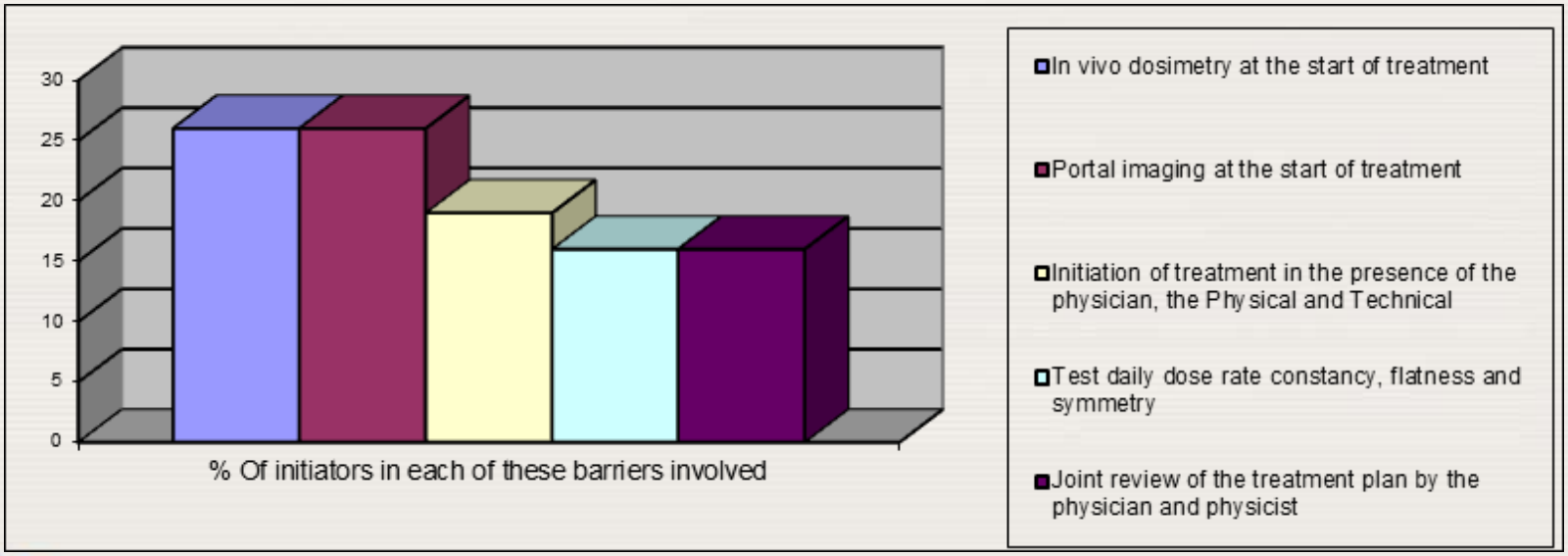

FIG. Barriers with highest contribution in reducing risk at the of LINAC Teletherapy services

Prospective risk analysis 2

A. PAZ GARCIA BELTRAN (Mexico) et al. - MAIN RESULTS OF THE RISK ASSESSMENTS TO SOME IBERO AMERICAN RADIOTHERAPY FACILITIES USING SEVRRA SOFTWARE

- Applying risk matrix method using SEVRRA (risk evaluation software tool), developed at the Mexican regulatory body in cooperation with FORO
- Accident initiators that could occur in users facility selected; barriers, frequency reducers or consequence reducers in users facility selected; Output: accident initiators with “high” or “very high” risks, and missed barriers for reducing risks

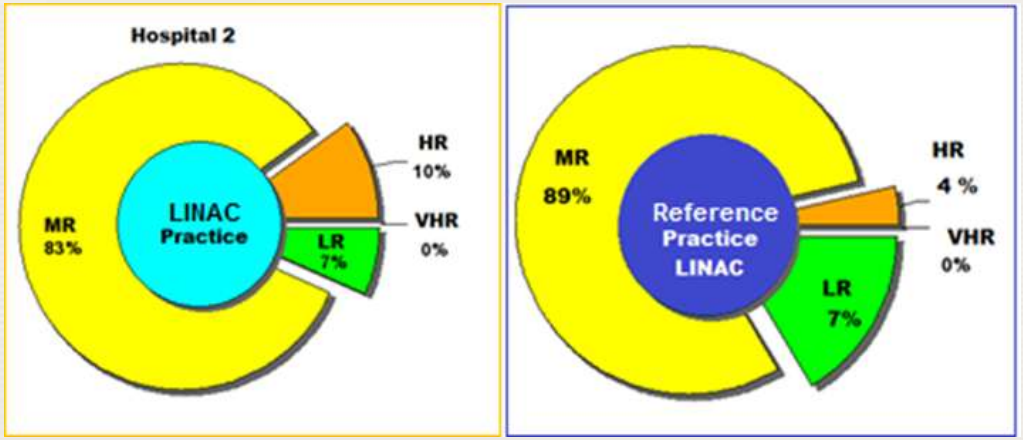

FIG. Risk distribution of a linear accelerator facility “Hospital 2” compared with the risk distribution of a LINAC reference facility

Prospective risk analysis (Other)

L.N. RODRIGUES (Brazil) et al. – (PSA implementation)

F.C. TEIXEIRA (Brazil) et al. – (FMEA used for stereotactics)

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External quality audit 1

E. GERSHKEVITSH (Estonia) et al. - IAEA SUPPORTED NATIONAL TREATMENT PLANNING SYSTEM AUDIT AS A TOOL TO IMPROVE SAFETY AND QUALITY IN RADIOTHERAPY

- TPS audit of national auditing organizations (supported by IAEA) in 8 European countries, through on-site visits
- TPS calculated doses are compared with ion chamber measurements performed in an anthropomorphic phantom for 8 test cases per algorithm/beam
- 186 datasets (combination of algorithm and beam quality) reviewed - dosimetry errors not related to algorithm limitations were detected in 10% of the datasets
- CT numbers to relative electron density conversion curves needed adjustment in about two thirds of the centres

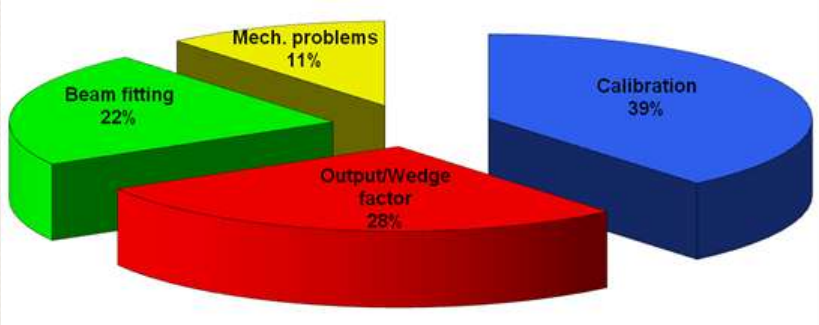

FIG. Reasons for dosimetric errors

External quality audit 2

P.N. JOHNSTON (Australia) et al. - THE AUSTRALIAN CLINICAL DOSIMETRY SERVICE - A NATIONAL AUDIT IN THE AUSTRALIAN CONTEXT

- Scope: Over a three year period the ACDS must develop a three level audit program capturing 80% of existing linacs in Australia and half of all new linacs commissioned for clinical use
- The ACDS has audited more than 30 linacs in its eighteen months of operation. A full suite of audits will be deployed over the next two years.

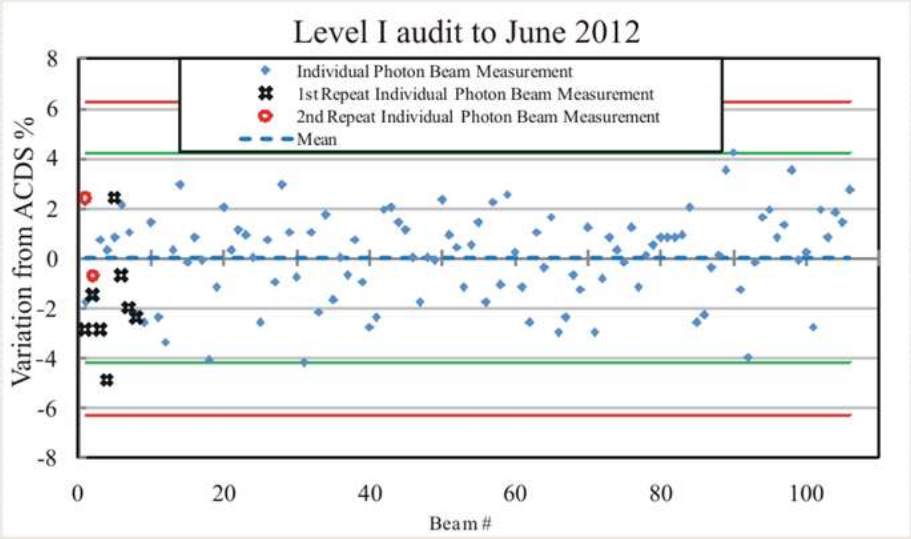

FIG. Level I (Dose-to-water). Green and red lines are the 2 sigma and 3 sigma defining Action Level and Out-of-Tolerance Level

External quality audit (other)

L.T. CAMPOS (Brazil) et al. – (External quality audit in stereotactics with head-phantom, TLD and radiochromic film)

M. PYLYPENKO (Ukraine) et al. – (Creation of national postal dose audit programme)

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Dosimetry

W. NYAKODZWE (Zimbabwe) et al. - CHARACTERIZING SILICON DIODES RESPONSE FOR RADIATION MEASUREMENTS

- Characterization of p-type diodes under different conditions, include gantry angle, field size and off axis positions
- Deviations of about ±7 % observed in the curved surface measurements
- Diode correction factors assist to set clinically achievable tolerance or action levels

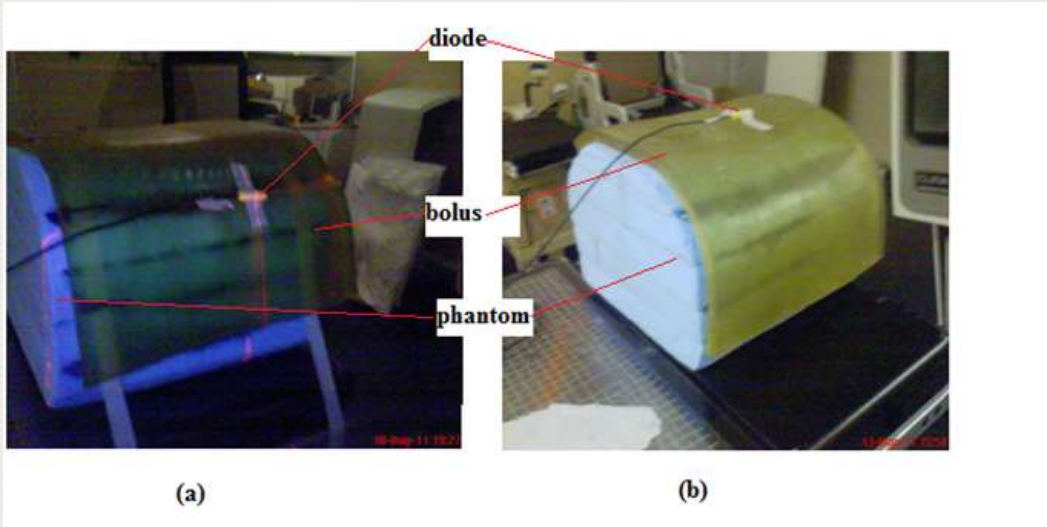

FIG. Diode setup and positioning on phantom for (a) diode placed on curved surface, and (b) diode placed on flat surface.

Dosimetry (other)

C.F.E. ALVES (Brazil) et al. – (Construction of shielded container for storing brachy Cs source, which can also be used for constancy check of ion chambers)

M.A. BERO (Syria) – (Gel dosimetry for verification)

K. CHEŁMIŃSKI (Poland) et al. – (Film dosimetry to validate commercial 3D detector arrays)

P.D. HARTY (Australia) et al. – (Direct calibration of reference chambers in Linac beams)

A. ISMAIL (Syria) et al. – (Real-time in-situ dosimeter for implantation)

A.G. KARAMLOO (Iran) et al. – (Calibration of n-type diodes)

M. MELCHOR (Spain) et al. – (Verification of IMRT cases using diode array)

F.B.C. NONATO (Brazil) et al. – (Two homemade pp chambers in kV x-rays)

L.A. RIBEIRO DA ROSA (Brazil) et al. – (EPID for regular linac QA vs. ion chamber matrix)

F. SALINAS (Argentina) et al. – (Simplifying checks with EPID and in-house s/w)

Dose outside target

M.R. EXPÓSITO (Spain) et al. - NEUTRON CONTAMINATION IN RADIOTHERAPY TREATMENTS - EVALUATION OF DOSE AND SECONDARY CANCER RISK IN PATIENTS

- Real time measurement of neutron production inside the treatment room and estimation of the neutron equivalent dose in organs of patients
- Definition of Uncomplicated and Cancer-Free Tumour Control Probability (UCFCP), where neutron induced secondary cancer is taken into account

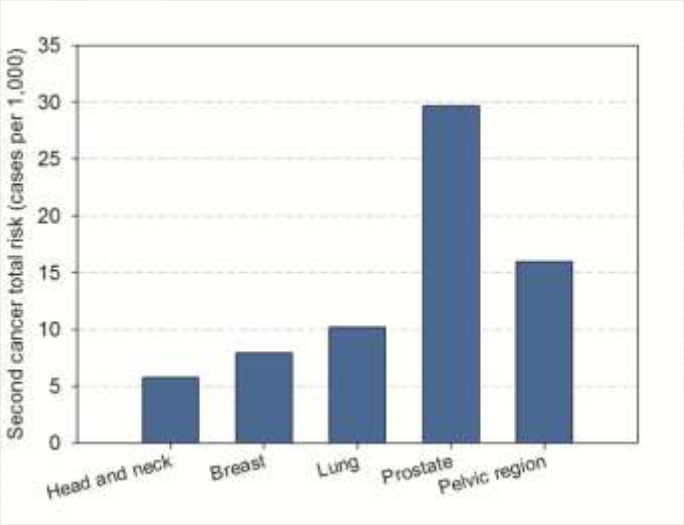

FIG. Calculated secondary cancer risk for different pathologies in a 15 MV Varian Clinac

Dose outside target (other)

R. MANICKAM (India) et al. – (Relative scatter dose measured with MLC, EDW and physical wedge)

M.S. RAHMAN (Bangladesh) et al. – (TLD in Alderson-phantom to measure dose to nearby critical organs and also compare with treatment plan)

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Imaging in radiotherapy

M. RODRIGUEZ-PONCE (Mexico) et al. - SURFACE DOSE FOR CONE BEAM CT SCANS FOR HEAD AND NECK CANCER TREATMENTS

- Dose to the surface of a Varian NORM Phantom (patient diameter<25 cm) due to cone Beam CT image acquisition measured using radiochromic films
- Total skin dose for head and neck cancer patient after complete treatment scheme could be as high as 4.4 Gy if using High Quality Head and Neck CBCT modality
- This may be reduced to less than a fifth using other CBCT modalities, still obtaining a sufficient image quality.

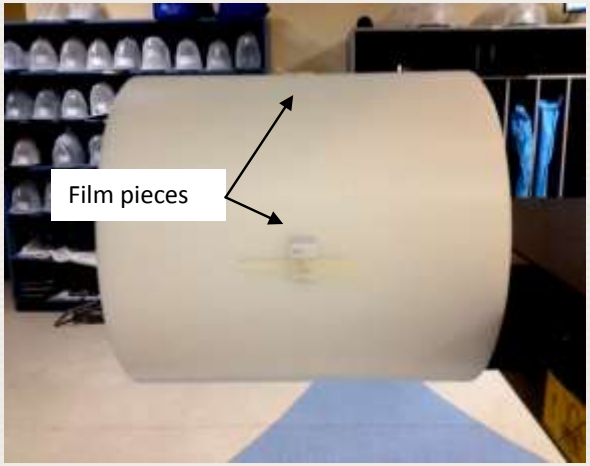

FIG. Placement of EBT films on the NORM PHANTOM

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Imaging in radiotherapy (other)

V. DUFEK (Czech Republic) et al. – (MV CBCT scans, MV orthogonal images and kV CBCT scans organ doses measured in anthropomorphic phantom; calculated effective dose ranging from 0.1 to 26 mSv; patient additional total effective dose from pelvic MV CBCT scans in every fraction exceeds 900 mSv)

A. MARI (Italy) et al. – (CBCT can add significant dose to patients organs outside PTV; example of reducing dose to contralateral breast using bismuth shielding)

C.A.L. NIEMEYER (Brazil) et al. – (Treatment planning using PET/CT – Manual target delineation versus Standard Uptake Values)

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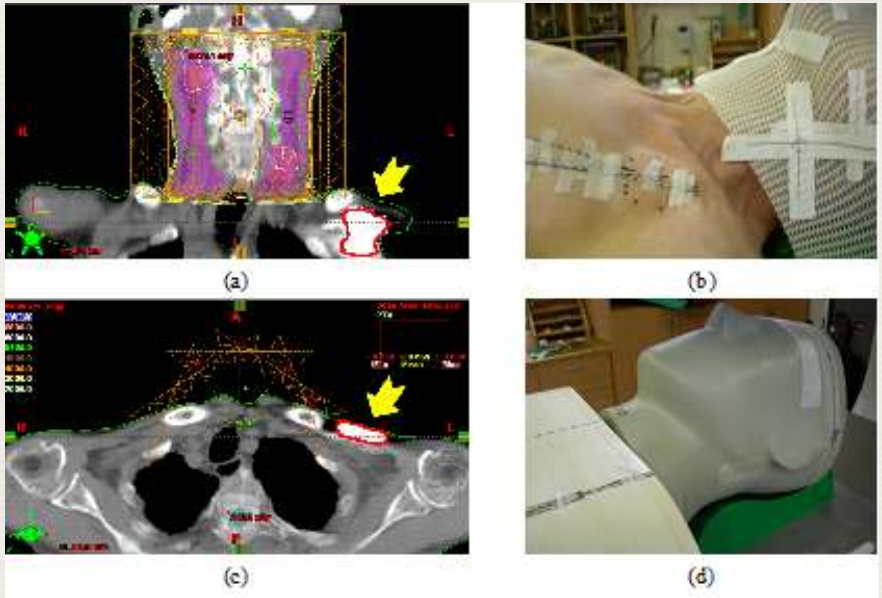
Procedure

J.W. LEE (Korea) et al. - ANALYSIS OF CUMULATIVE DOSE TO IMPLANTED PACEMAKER ACCORDING TO VARIOUS IMRT DELIVERY TECHNIQUES: OPTIMAL DOSE DELIVERY VERSUS DOSE REDUCTION STRATEGY

- Calculated dose volume histograms of the pacemaker showed insignificant dose differences for sliding-window and step-and-shoot IMRT
- Measured doses (MOSFET detector) showed 2-4 times higher doses than predicted values in a planning system
- Customized lead block effectively achieved reduction of pacemaker dose up to 60%



Procedure (other)

C. CASTELLANOS (Dominican Republic) – (Parameter for scoring IMRT plans in order to decide on clinical use)

J.B. CHUNG (Korea) et al. – (Reducing testicular dose with bolus)

L.B. PARKHOMENKA (Belarus) et al. – (Radiation protection at treatment of head and neck cancer)

E.S. RASLAWSKI (Argentina) – (Radiation protection of paediatric patients)

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Technology and Radiobiology (other)

R. ALFONSO-LAGUARDIA (Cuba) et al. – (Electron Arc Therapy)

Y. ASCENCIÓN YBARRA (Cuba) et al. – (Software for Monitor Unit verification)

A.G. CORDERO RAMÍREZ (Costa Rica) – (MLC mechanical parameters evaluated using EPID)

R. SANSOGNE (Argentina) et al. – (Distribution of equipment in Argentina)

K. SERGIEVA (Bulgaria) et al. – (Proton treatment)

M. ZAMANI (Iran) et al. – (Monte Carlo calculations for BNCT)

D. DUBNER (Argentina) et al. – (Response of immune system in inflammatory reactions of patients with acute and late skin injuries following radiotherapy)

M. PORTAS (Argentina) et al. – (Diagnosis and treatment of localized radiation induced injuries)

P. SIRAPRAPASIRI (Thailand) et al. – (Immunological impact of radiotherapy in HIV-patients)

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Occupational radiation protection 1

B. MUKHERJEE (Germany) et al. - OPERATIONAL HEALTH PHYSICS DURING THE COMMISSIONING PHASE OF THE WEST GERMAN PROTON THERAPY CENTRE ESSEN

- Proton beams of energies varying from 80 to 225 MeV in four treatment rooms
- Investigation of radiation exposure from leakage radiation through treatment room and labyrinth walls as well as activation of beam apertures, beam-shaping compensators, and various types of phantoms
- Shielding was found to be acceptable; Commissioning work rules recommended

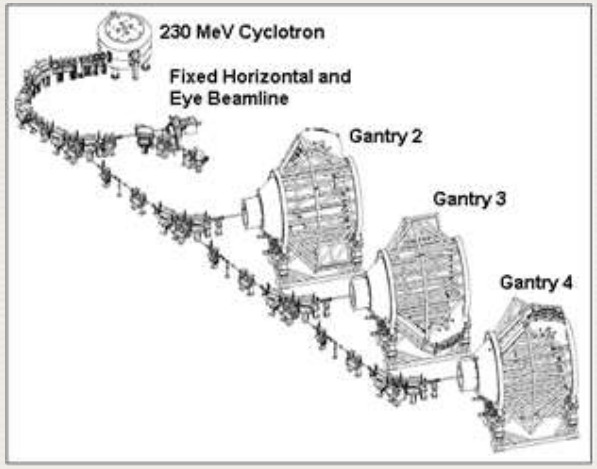

FIG. The skeletal perspective of the WPE facility

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Occupational radiation protection 2

A. LACHOS DAVILA (Peru) et al. - RADIOLOGICAL ACCIDENT DUE TO DIRECT EXPOSURE TO COBALT 60 SOURCE. FOLLOW-UP AFTER 16 YEARS

- Accident (1995) at a radiotherapy department in Peru, affecting an electrician called to repair a Cobalt-60 unit where source was stuck
- Failing to re-introduce the source into the holder with the steel rod (mechanism broken), he held the source in his hand with common gloves for about 5 s
- The case report is a summary of the monitoring of biological effects and results of medical long-term studies for 16 years

FIG. 2011, after surgery and physical therapy, achieving ability to pick up things

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Safety learning

Ú. FINDLAY (UK) - DEVELOPING A NATIONAL REPORTING SYSTEM IN RADIOTHERAPY - THE HPA EXPERIENCE

- HPA team supports the development of the national reporting system for radiotherapy, undertake the analysis of the data collated through this system and regularly publish reports
- Adoption of terminology, classification and coding from “Towards Safer Radiotherapy” by radiotherapy departments in the UK

J. MALICKI (Poland) et al. - RISK ANALYSIS OF ACCIDENTAL AND UNINTENDED EXPOSURES IN RADIOTHERAPY

- EC has established and funded the ACCIRAD project which has the objective to perform a study on the implementation of the Council Directive 97/43/EURATOM (Medical Exposure Directive, MED) and to develop guidelines on risk analysis of accidental and unintended exposures in external beam radiotherapy

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Safety learning (other)

K. ASNAASHARI (Iran) et al. – (Review of errors in clinical practice; 165 errors recorded for 6000 patients)

P.K. DASH SHARMA (India) et al. – (Includes information on ARIS, a web-based system under development for reporting to regulatory authorities, including events in medical uses of radiation)

I. HORAKOVA (Czech Republic) et al. – (Summary of accidental exposures and near misses during 2005-2011, examples and lessons learned)

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Safety learning (SAFRON)

SAFRON – Safety in Radiation Oncology – Developed by the IAEA, anonymous, voluntary, educational reporting system for safety related events in radiotherapy

Comprehensive source of information (reports, links, publications) – collaborating with other reporting systems

Released for general use after this week – go to rpop.iaea.org

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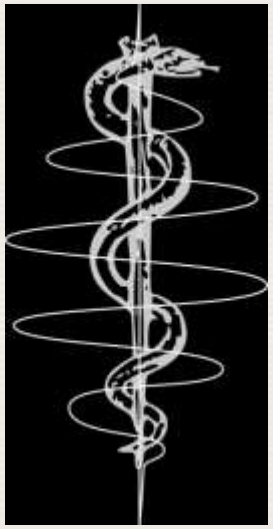
Conference symbol

- “The rod of Asclepius” – not the staff of Hermes (on which the caduceus is based)
- “Pharmakon” meant both "medicine" and "poison" in the ancient Greek language
- Two sides to the snakes venom (venom and basis for antivenom)
- Two sides to radiation



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