

Session 4

Radiation Protection of patients, staff and public during therapeutic use of sealed and unsealed sources

Introductory remarks

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International Conference on Radiation Protection in Medicine

- Setting the scene for the next decade -

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Topics of the session

Brachytherapy
or sealed source radiation therapy

$^{125}\text{I}/^{103}\text{Pd}$, ^{125}I , ^{90}Y

Unsealed source radiotherapy
or systemic radioisotope therapy

^{131}I , ^{153}Sm , ^{89}Sr , ^{90}Y
Radioimmunotherapy

Ungrouped

Intraoperative radiation
therapy



Challenges

Radiotherapy is a **dynamic** medical area

- rapid technological development (hard- and software)
- novel applications of radionuclides
- new treatment protocols
- increasing complexity
- high radioactivity

Challenges

Sealed sources
Unsealed sources



Essential characteristics e.g.

- *Type of radiation (Beta, Gamma, Alpha)*
- *Energy*
- *Chemical composition (except accelerators)*
- *Format/size of source (except accelerators)*



**Potential for accidents with serious consequences
Safety provisions and safety strategies necessary**

Exposure

Patients – high doses for patients from radiotherapy and imaging (treatment planning, dosimetry); no limits

Staff – preparation, application of high activity, local skin doses, limits for occupational exposure

Public – patient release, radionuclide release to environment, care givers, limits for public exposure and discharges (control mechanisms?)

Brachytherapy

1930 – interstitial radium therapy

remote afterloading system and use of new radioactive sources since late 60's reduced the risk of unnecessary radiation exposure to the operator and patients

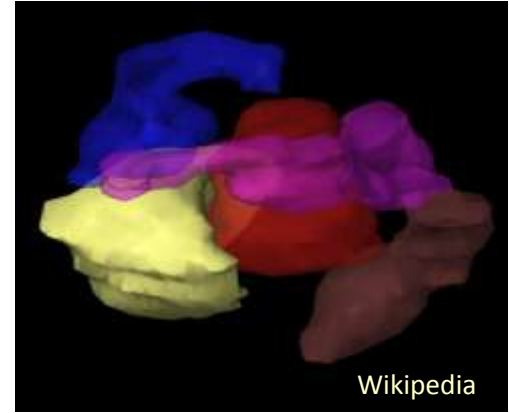
+ nowadays

- three dimensional imaging modalities
- computerized treatment planning systems
- delivery equipment

brachytherapy a safe and effective treatment for many types of cancer but

management of sources and equipment needs still consideration

radium brachytherapy – phased out today globally??



28 incidents in Germany 1999 – 2010:

- *Construction errors*
- *Unsufficient training*
- *Malfunctions*
- *Systematic error in calculation of dose (overdose)*

IORT – Intraoperative Radiation Treatment

- >20 years old technique, used instead of conventional beam therapy or brachytherapy
- New types of machines - expanding technology (compact mobile X-ray sources)
- Radiation used in an „open“ patient – a new challenge?
- Trust on manufacturer of the equipment – difficult to verify the dose ???
- **Patient dosimetry essential for determination of doses to treatment areas or organs at risk to avoid unnecessary exposure !!!**



INTRABEAM
Radiotherapy System



Carl Zeiss

Radiation Safety Issues

- Patient safety by qualified treatment planning and dose calculation
- External exposure of staff and public
- Incorporation by staff at preparation and application
- Contamination of staff at preparation and application
- External and internal contamination of public by excretion of radionuclides
- Contamination of environment

Radiation Safety Measures

To minimize risks of accidents

Ensuring high and consistent standards of practice

Comprehensive programme of quality assurance for medical exposure

- *Evaluation of patients during and after the treatment,*
- *Education and training of radiological medical practitioners, technologists medical physicists, radiochemists, radiopharmacists and non-radiology professionals ,*
- *Commissioning, calibration and maintenance of equipment,*
- *Independent audits for dosimetry and treatment planning,*
- *Maintaining records,*
- *Protocols for treatment procedures,*
- *Supervision of delivery.*

UNSCEAR 2008, BSS 2011



Radiation Safety Measures

Release of Patients after radionuclide therapy

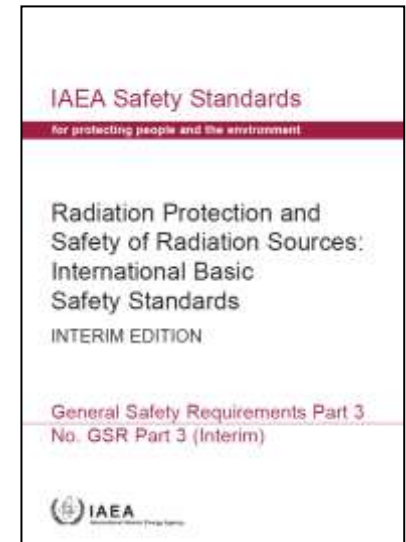
Req. 40 of BSS 2011:

Registrants and licensees shall ensure that there are arrangements in place to ensure appropriate radiation protection for members of the public and for family members before a patient is released following radionuclide therapy

?

Holding tanks vs no holding tanks

?



The IAEA recommends „that in most situations it is better to dilute and disperse the waste activity in a continuous sewage system, rather than to concentrate and store activity for decay.“

(IAEA Statement from February 2010, also discussed in GoE Art. 31 EURATOM)



Session 4:

L. Dauer

Radiation protection in brachytherapy in the next decade

S. Mattson

Radiation protection in radionuclide therapy in the next decade

G. Glatting

Developments in patient dosimetry for unsealed sources

A. Hosono

Summary of contributed papers

DISCUSSION

