QMRT.BE

Belgian Quality Managers in Radiotherapy

Turning Incidents Into Growth

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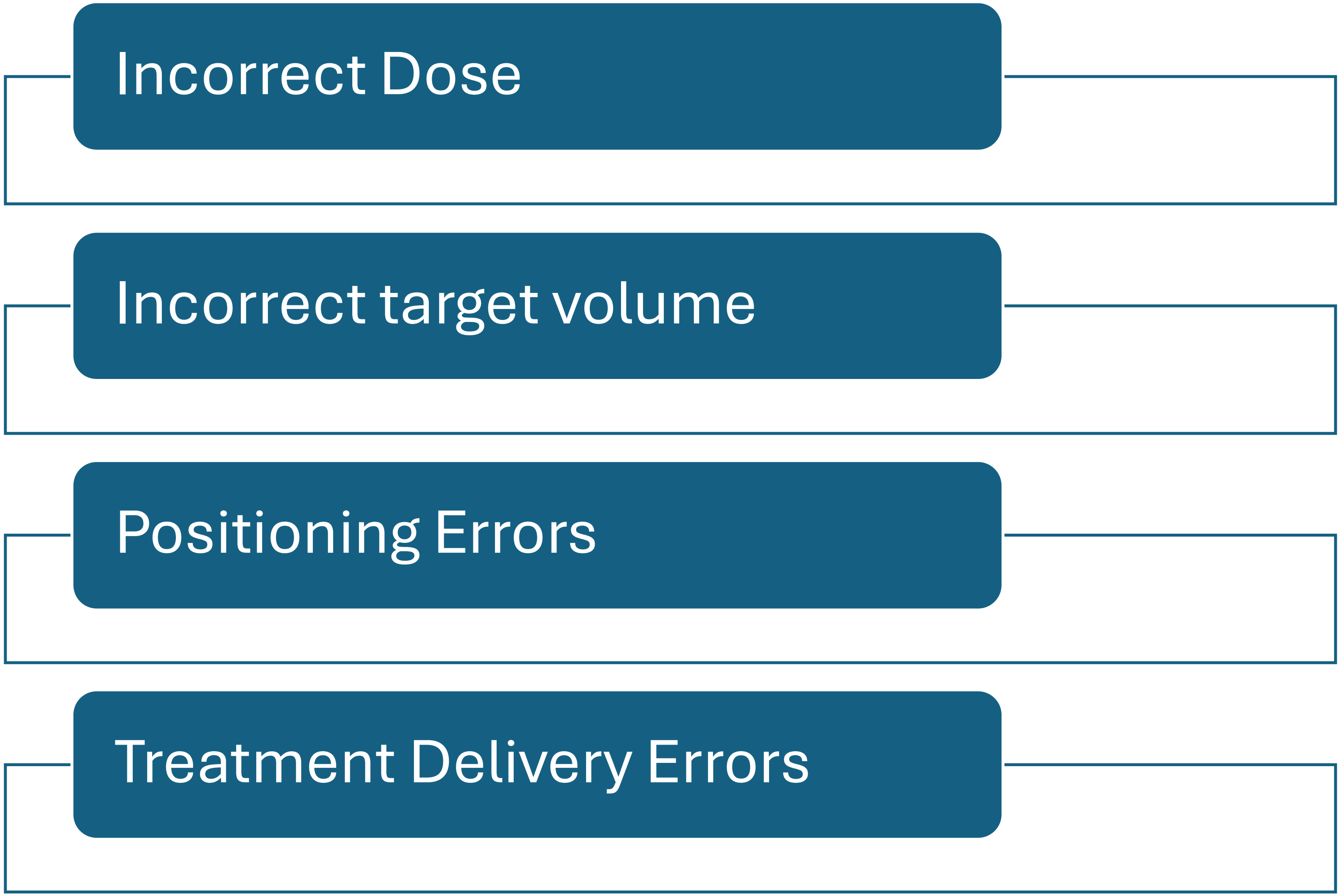
Introduction

Overview of Radiotherapy Incidents

- ➢ Analysis of ASN, AFCN, FANC, SAFRON, NRC Incidents and Pubmed..

Analysis of ASN, ACFN, FANC, SAFRON and NRC Incidents



Analysis of ASN, ACFN, FANC, SAFRON and NRC Incidents

- Incorrect Dose
- Incorrect target volume
- Positioning Errors
- Treatment Delivery Errors

Main Causes

- Wrong dose due to scheduling errors/ fractionation sheme
- Overdosage due to implementation of new practices
- Post maintenance:
  - Workpressure after maintenance
  - Not following the correct service procedure
- Configuration error in the dose calculation software.
- PTV margin errors
- Incorrect Isodose

Incorrect Dose

E.g. Scheduling errors/ fractionation sheme

- Prescription: 54 Gy over 3 Fraction to be delivered once weekly
- Incident: Fx 1 and 2 were delivered in the same week

-> Time out Procedure includes review prescription

Incorrect Dose

E.g. Overdosage due to implementation of new practices

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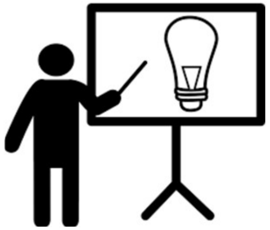
- Procedures updated
- implemented checklist for dose controle
- Education
- commissioned the software for use of SRS with >3 locations

Incorrect Dose



Lesson Learned:

- Software & system validation
- Double-check of dose
- Double check prescription VS treatment appointments
- Standardization of prescriptions
- Dose constraints & QA

Incorrect Dose

Incorrect Dose

Incorrect target volume

Positioning Errors

Treatment Delivery Errors

Main Causes:

- Laterality errors (left vs. right side confusion).
- Outdated target volume used (old vs. current plan).
- Lack of robust linkage between planning system and delivery system (manual mismatches).
- Misinterpretation of diagnostic or planning images.
- Error in the written prescription

Incorrect target volume

E.g. Wrong prescription

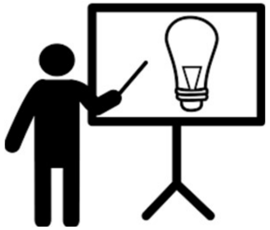
- Error made in the prescription: left lung instead of the right lung and ended up being treated on the left lung

Corrective actions:

➔ Check of the prescription with the medical record

➔ Systematic questioning the patient on which side they will be treated

Incorrect target volume



Lesson Learned:

- **Checklist & time-out**
- **Imaging and contour verification:** Double verification of contours (physician + physicist/colleague physician).

Incorrect target volume

Incorrect Dose

Incorrect target volume

Positioning Errors

Treatment Delivery Errors

Main causes:

- Laterality errors (left vs. right side confusion).
- Wrong vertebra or adjacent anatomical site identified.
- Incorrect reference mark was drawn due to improper table positioning or incorrect placement of the base plate.
- Wrong indexation/use of the immobilization device
- Inadequate communication which led to patient being treated with no breath hold
- Wrong patient on the table

Positioning Errors

E.g. wrong vertebrae

- vertebrae D12-L1 were treated instead of D11-D12
  - Due to Mismatch/wrong image

→ Refresher/Education

→ Time-out procedure defined with stricter correction limits and physician check for large deviations.

→ 2 RTT's (double checking)- take away administrative tasks (no distraction)

→ Full visual overview of the anatomy of the patient to be sure that you're looking into the correct vertebrae

Positioning Errors

Positioning Errors

E.g. wrong immobilization device :

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RTTs must verify plan + immobilization setup before irradiation.

Lesson Learned:

Positioning Errors

- Double-check of setup
- Indexing & immobilization: Checklists before irradiation
- Education image registration – Time out procedure!
- Full visual overview

- Incorrect Dose
- Incorrect target volume
- Positioning Errors
- **Treatment Delivery Errors**

Treatment Delivery Errors

Main causes:

- Used softwares not linked – prone to human error
- Wrong CBCT protocol
- MLC not used

E.g. MLC not used in Treatment

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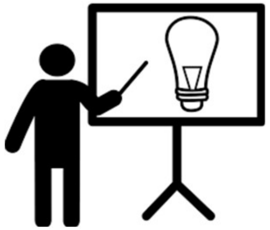
Dedicated-consistent treating team
Accessory clearly noted

Treatment Delivery Errors



Lesson Learned:

- Equipment & accessory check
- Time out procedure before start treating
- Training

Treatment Delivery Errors

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Multi-institutional SBRT incident learning: evaluation of safety barriers using a human factors analysis and classification system

Ross McGurk [1], Katherine Woch Naheedy [2], Tara Kosak [3], Amy Hobbs [4], Brandon T Mullins [1,#], Kelly C Paradis [2], Meghan Kearney [3], Donald Roback [4], Jeffrey Durney [3], Karthik Adapa [1], Bhishamjit S Chera [1,†], Lawrence B Marks [1], Jean M Moran [2,*], Raymond H Mak [3], Lukasz M Mazur [1]

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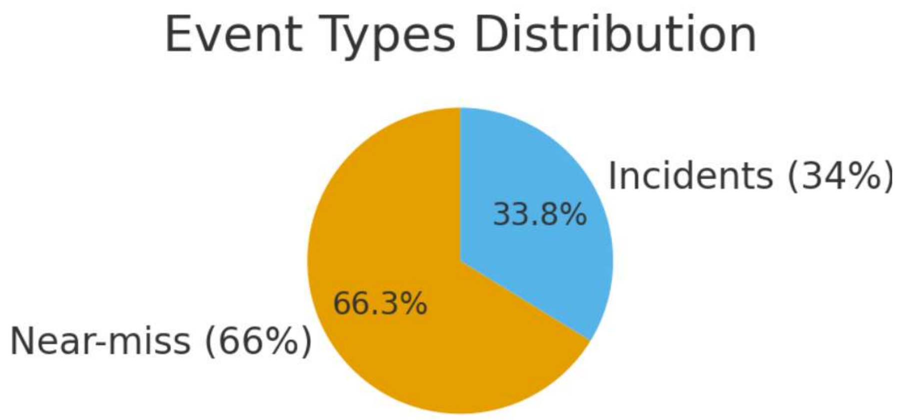
PMCID: PMC9771927 NIHMSID: NIHMS1823317 PMID: 35948321

2014-2019

4 independent institutions

160 events



- **<u>Low-severity incidents:</u>**
  - Lack of equipment
  - Setup shift not applied prior to imaging
  - Collisions with immobilization devices
  - Scheduling issues causing patient delays
- **<u>Medium-severity incidents included:</u>**
  - Treatment on consecutive days vs every-other-day as prescribed;
  - extreme weight gain between planning and treatment with one fraction of their SBRT course delivered before re-planning;
  - an incorrect planning target volume (PTV) margin used for 1 out of 5 liver SBRT fractions;
  - a patient positioned with sub-optimal alignment for 1 of 5 multilevel spine SBRT treatments.

Stage of origin:

- Treatment planning: 38.1%
- Pre-treatment review/verification: 37.5%
- Treatment delivery: 31.2%

In the majority of cases (95%), safeguard failure was caused by human error:

- Condition of the operator
  - Inattention/distraction
  - Workload
  - Time pressures
- Documentation
- Communication

Conclusions

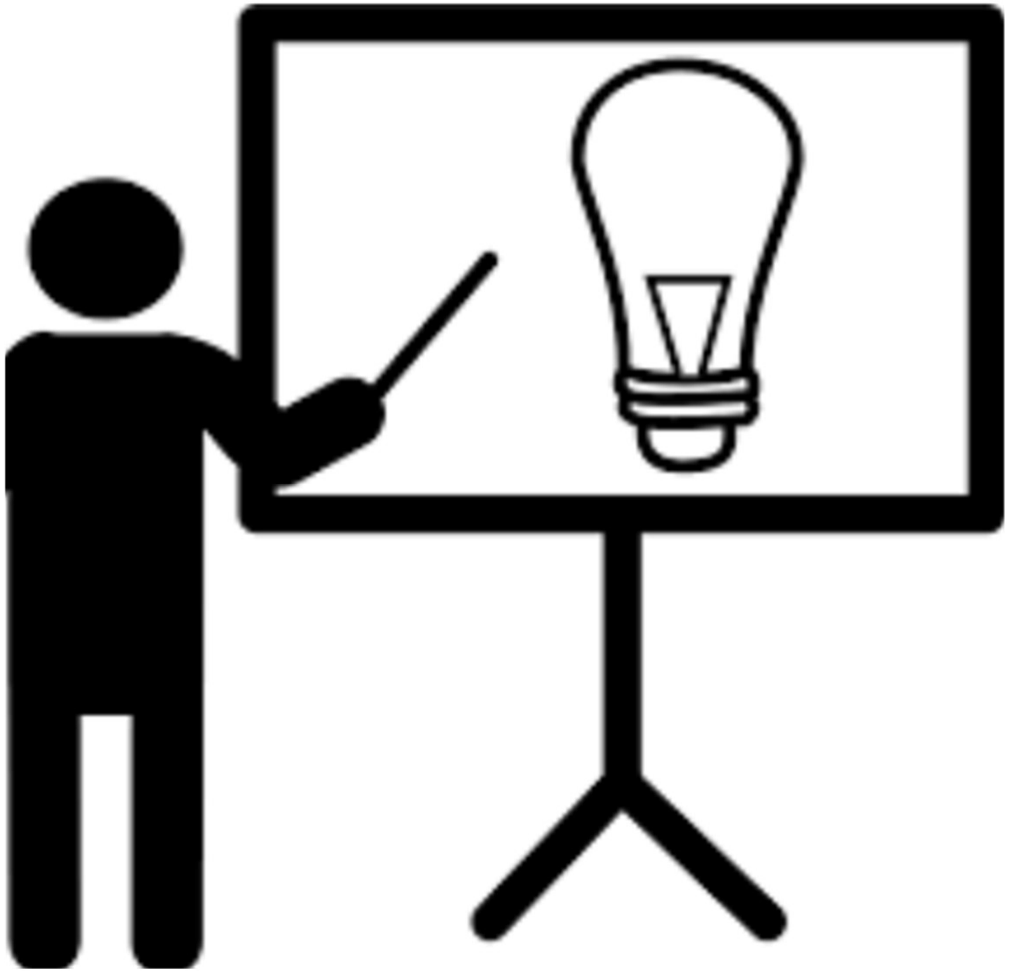
- SBRT is vulnerable to system failures, especially in planning and delivery stages.
- Safety barriers often do not hold due to human factors and systemic strain.

Suggested improvements include:

- Better communication & documentation
- Reducing time pressures, distractions, and excessive workloads
- Introducing and continuously improving existing controls

Lesson Learned

- Human errors mostly caused by time pressure and complexity
- Software and equipment must be properly synchronized
- Procedures and checklists prevent many incidents
- Training and education are crucial



Take Home Message

SAFETY STRATEGIES REDUCE RISK IN STEREOTACTIC RADIOTHERAPY

COMBINATION OF PROCEDURE, TECHNOLOGY, AND TRAINING IS KEY

MONITORING AND AUDITS OF EXISTING CONTROLS ARE RECOMMENDED