INTRODUCTION

Doses from medical applications

Norwegian numbers

CONTRIBUTION TO COLLECTIVE DOSE - 2008

FACTS: Diagnostic medical applications biggest contribution to collective dose from man-made sources

FACTS: Staff performing interventional procedures receives the highest occupational doses

Optimization – core stone in RP

Dose to patient and staff as low as reasonable achievable (ALARA)

BUT

High enough to ensure adequate image quality to answer the clinical question

OPTIMIZATION – IMPORTANT FACTORS

Awareness, attitude and RP culture

Optimization implemented in QA-system

Type of equipment and QC/maintenance

Standard exposure protocol and individual adjustment of scan parameters

Working technique

Available staff and E&T in RP

Knowledge of dose and identification of high/low doses

Need for:

A tool to identify examinations with high/low doses

SUMMARY AND CONCLUSIONS

Significant variation in dose to patients from the same examination

- X-ray thorax: max/min-ratio: 21
- CT thorax: max/min-ratio: 8

Huge potential for optimization of X-ray and CT examinations

Proper optimization can reduce

- contribution to collective dose from medical applications
- radiation risk for chronically ill patients (frequently CT)
- radiation risk for staff performing interventional procedures

Røntgen thorax

Delineation

Digital detector

Film-folie

CT thorax

Dose to medical staff

CT (thorax)

DAP [Gycm²]

DLP [mGy cm]

High enough to ensure adequate image quality to answer the clinical question

Image Quality

Dose

Premise: Multidisciplinary team with sufficient competence in RP

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Tool for optimization: Standard dose and national DRLs

<table>
<thead>
<tr>
<th>Task</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Establish local standard dose</td>
<td>Mean 20 patients, one lab, one exam</td>
</tr>
<tr>
<td>National reporting to NIPA</td>
<td>National dose distribution</td>
</tr>
<tr>
<td>Establish national DRL</td>
<td>75th percentile of national dose distribution</td>
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</tbody>
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Use:
- Tool to identifying unusual high/low patient doses
- Identify the reason
- Corrective actions

Result:
- Equipment: QC/calibration
- Optimization: protocol/technique
- Focus on dose and image quality
- Increase knowledge

Inspections – A tool for increased implementation

**Definition**
- Verifying compliance with national Act and regulations
- Identify non-conformities
- Administrative reactions
  - Compulsory fine, withdrawal of authorization, shut down, prison, etc.

Not to be mixed up with audits
- Audits are made by peers
- Evaluate compliance with guidelines (‘gold standard’)
- Not associated with administrative reactions by an authority
- Up to hospital to implement non-conformities

Different levels in the verification process

**REVIEW OF SYSTEM**
- RP organization, RPO, MPE
- Quality system, notification system and documents
  - Procedures / instructions
  - Responsibilities / tasks
  - Approval, revision, traceability
  - Easily available / user friendly
- Internal audits
- Staff and E&T
- Interviews of hospital management and responsible persons
- Demonstration of QS, etc.

**LEVEL OF IMPLEMENTATION**
- Verify compliance with QS
  - Procedures and instructions known and in use
- Interviews of staff
- Observations / demonstrations
  - Procedures and room / areas
  - Working techniques
  - Equipment
- On-site spot checks
  - Verify documentation

Inspecting optimization of protocols

- Verify if standard protocols are available at equipment
- Procedure for revision standard protocols, multidisciplinary team, last revised
- Procedure for establishing local standard doses
- Verify if dose parameters on equipment is calibrated, calibration date
- Overview of established local standard doses and comparison with national DRLs and other benchmarking (departments, labs)
- Reason to high/low doses analyzed and corrective actions taken
- Interviews to verify if procedures are known and followed
- Documentation of optimization activities

Inspecting equipment and QC (1)

- Observation of equipment – intended use?
- Procedure for purchase – right staff involved (MP, radiologist, etc.)
- System for maintenance and QC (in QA-system?)
  - Service contracts or maintenance by local medical engineers
  - Responsible staff for QC, MP involved at appropriate level
  - Coordination between maintenance and QC
  - Yearly plan – verify if followed
  - Procedure for calibration of measuring instrument
  - Method books for QC, acceptability criteria, action criteria, etc.
  - Actions when deviations from QC
Inspecting equipment and QC (2)

- Interviews to verify if procedures are known and followed
- Verifications (spot checks)
  - Verify calibration certificate, date
  - QC report for CT lab 2
  - Follow up of deviations

Inspecting education and training

- Qualification requirements of staff (education)
- System for local E&T in RP and use of equipment, (scope, content)
- Verify documentation – All staff received appropriate E&T?
- Interviews and demonstrations to verify level of competence and knowledge in RP

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Observations / demonstrations

- Room layout
- Equipment and dose indicator in room
- Personal protective equipment (availability/use)
- Dose reducing tools/techniques/parameters
  - Filtration, pulse rate, etc.
  - Use of automatic contrast injector
- Working technique
  - Geometry
  - Staff placement
  - Compression, grid (pediatric), etc.

Measurements

- Quality of equipment and viewing stations
- Calibration of instruments
- Shielding of room
- Dosimetric audits

Inspector competence

Basic knowledge:
- System review technique
- Interview technique
- Knowledge of quality systems and internal control systems
- National RP legislation
- How to behave in a clinical environment

Preferred additional knowledge:
- Clinical experience with medical applications
- Knowledge on factor influencing dose and image quality
- Measurement techniques

Summary and conclusions

- Huge optimization potential in medical applications
- Standard dose and DRLs an effective tool for optimization
- Inspection of both system and level of implementation
- Level of inspector competence affect the outcome

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Thank you for your attention!

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