Radiotherapy Risk Analysis from Incidence Reports at a National Level

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Introduction

In order to share data on patient risk during radiotherapy (RT) on a national level and to stimulate a learning potential between the RT-centers, a national special group of interest in RT (RT-SIG) under the national society for medical physics was formed in 2016. Since then RT-SIG has collected and analyzed patient risk data from six centers. RT-SIG is stimulating the centers to analyze and categorize data in an inter-center consistent way facilitating sharing of data and making common reports and recommendations on patient RT safety improvements.

Materials and Methods

Adverse and near miss incidence reports in RT are collected and analyzed locally at each center. Events are categorized by two different systems, 1 Patient Consequence Coding (PCC) and 2 RT Pathway Coding (RPC), se fig. 1.

PCC	Patient Consequence
1	Target / Organ at risk
2	Dose / fractionation
3	Delay / Waiting time
4	Concommittant treatment
5	Treatment unit / Equipment
6	Routine controls
7	Communication / documentation
8	Patient experience
9	End of treatment / follow-up
10	Miscellaneous

RPC	Radiotherapy Pathway
0	Scientific infrastructure
1	Room design
2	New equipment
3	Routine machine QA
4	Referral
5	Communication of intent
6	Booking process
7	Processes prior to first treatment
8	Pretreatment: preparation of patient
9	Mould room/workshop activities
10	Pretreatment activities/imaging
11	Pretreatment planning process
12	Treatment data entry process
13	Treatment unit process
14	On-treatment review process
15	Brachytherapy
16	End of treatment process
17	Follow-up process
18	Timing
19	Document management
20	Staff management

Fig 1. PCC codes for "RT failures to the patient". Note strength of failure is decreasing from 1-10.

RPC for pinpointing the RT-process at which failure originated.

Consensus surveys are performed twice a year in order to standardize local data analysis by the local center Risk Analysis Team. During 2017 local data were collected, and incidence patterns on a national level as well as on local RT-centers were analyzed.

Consensus Results

Consensus survey 2017: The 6 participating centers were asked to analyze the same 5 anonymized test incidence reports, fig 2.
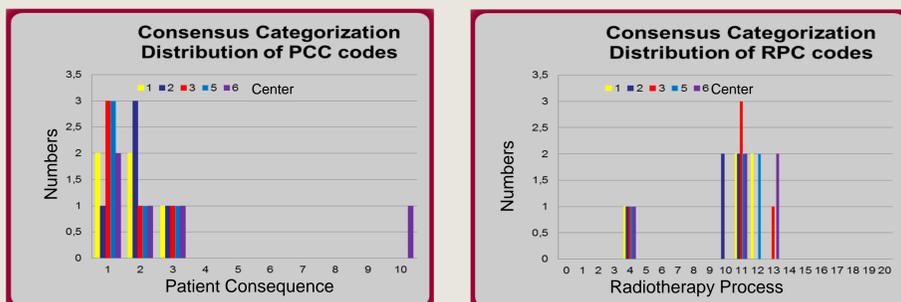

Fig 2. Categorizing results from 5 responding centers

On PCC-code 3 is observed full agreement, whereas a small deviation is observed for codes 1 and 2. The test case was a delineation error causing wrong dose to a part of the CTV. One team scored 10 because it was a near miss event.
For RPC-coding is observed relative big agreement in the deter-mination of the RT process at which the event occurred. These results suggest that inter-center results can be compared.

References : Toward safer radiotherapy, London: The Royal College of Radiologists (2008)

Conclusions

- Inter-center consensus in categorization by the PCC and RPC systems is obtained by training of risk analysis team
- Inter-center incidence reporting frequency per linac is varying by a factor 10 between the 6 participating RT-centers.
- Inter-center RT Risk profile as analyzed by PCC and RPC is very similar though different reporting frequency
- In DK most high-risk incidents and near-miss events are found in the planning process giving risk of systematic errors.
- Pooled national data have the potential of developing a system for early warnings of RT-risks between the centers and for common national recommendations on patient safety.

National Results

In 2017 261 incidence reports from 6 Danish RT centers were collected. No incidents leading to serious patient injury or death were found. The incidence reporting activity per clinical linac is quite different among the centers, (min 1.1, max 12.7, mean 5.9), however the risk patterns are quite similar, see fig 3.
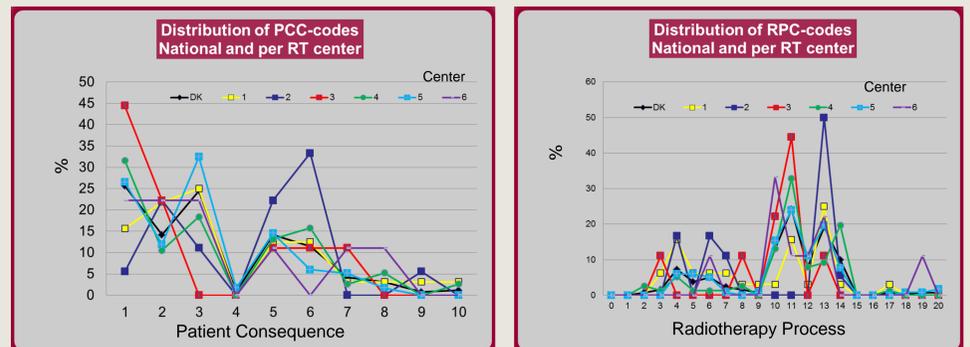

Fig. 3. Frequency of incidents on PCC and RPC codes per RT-center

Due to the similarity of incidents between the centers, the pooled national (DK) data may serve as a tool for early warnings of processes with special patient safety risks. For the national data it can be seen from the PCC distribution fig 3 that the majority of reported incidents are found to have (potential) consequence for the coverage of target/organs, dose or patient delay/waiting time. Similarly it can be seen from the RPC distribution that the majority of incidents are reported in the planning processes, CT, target delineation, dose planning and data preparation for treatment.
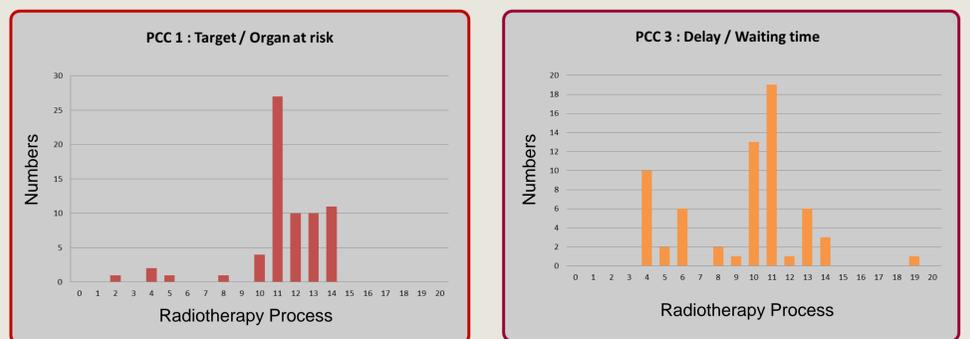

Fig. 4. RPC categorization of all incidents concerning the most frequent PCC-codes

67 national target / organ at risk and 64 delay / waiting time incidents are RPC analyzed. From the analysis, fig. 4, it is found that a natio-nal initiative on higher patient safety most predominantly should take place in the treatment planning process including target delineation. To prevent delay/waiting time first of all referral procedures and CT-scans and treatment planning processes should be improved.

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