

By Wiebke Kathmann, Ph.D.

Optimization of radiation dose performance

Across the globe, sensitivity towards patient safety and specifically, patient exposure to medical radiation is heavily increasing. The growth of medical imaging procedures, as well as the rising complexity of exams under image guidance, has triggered new regulatory guidelines in the U.S. and Europe for tracking, monitoring, reporting, and auditing radiation doses administered to patients during all imaging procedures. Since July, 2015 all hospitals and critical access hospitals in the U.S. must meet the New Joint Commission's "Revised Requirements for Diagnostic Imaging Service" [1].

Amongst other directives, these requirements state that a medical physics expert has to be consulted for each radiological examination above a defined threshold. This means that the Joint Commission has proposed some significant radiology process flow and quality performance standards that may require new ways of working for some healthcare providers. In Europe, new regulations are expected to be in place by 2018. The EURATOM directive 2013/59 ("EU directive for radiation protection") has to be implemented into national law by spring 2018 and requires a complete recording of patient dosages and relevant parameters. A combined goal of both directives is to

increase patient safety by a complete recording of the dosage administered from all modalities and an optimization of the imaging procedures.

A German hospital uses Siemens Healthineers teamplay to reach the goal of dose optimization over the complete radiology portfolio

Radiation dose management solutions have gained remarkable importance in this context over the last five years, owing to their advantages over traditional manual methods for patient dose optimization. These tools are helping to generate transparency across the imaging fleet, enabling the analysis and understanding of dose values. One dedicated solution is a cloud-based network, called "teamplay" developed by Siemens Healthineers that creates transparency over the entire radiology department, from CT to mammography.

At Krankenhaus der Augustinerinnen a Catholic hospital in Cologne, Germany, dose standardization and optimization are key. Optimal medical and pastoral care of the patient are a top priority, and the hospital enjoys a good reputation offering a broad spectrum of medical examinations. Frank Schellhammer, MD, Chief of Radiology and a neuroradiologist by training, is proud that his department is able to offer a broad radiological portfolio. For Schellhammer, a key goal is dose optimization over the complete radiology portfolio. And teamplay from Siemens Healthineers provides a tool to support him and his team in reaching this dose management goal by offering clear and intuitive dose performance graphics.



Fig. 1.: For Frank Schellhammer, MD, the dose limits he has defined for his institution are crucial. These institutional reference values are lower than the German national reference values.

The Authors

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Intuitive graphical user interface

Schellhammer considers teamplay a valuable add-on which he has come to rely on to quickly evaluate the dose performance of all CT scans in his department. He has developed a habit of looking over the past weeks' images before leaving his office on a Friday night. With teamplay, it only takes him a couple of seconds. The first screen gives a graphical representation of where he stands regarding dose. It tells him what percentage of the CT scans are within the dose limits of the national reference values.

More important for Frank Schellhammer, however, are the dose limits he has defined for his institution. These institutional reference values are lower than the German national reference values and therefore have a better impact on patient care. "One glance tells me whether or not I need to be nervous." Going one step further, he finds the information on when and why the scan was performed. He quickly finds all the data needed to evaluate a particular scan (organ, type of examination, individual scan, indication) and the answer as to why a specific scan required more radiation than normal.

Data transparency

Schellhammer uses teamplay in two ways: First, to rapidly identify any dose outliers and then retrieve specific exams for closer inspection. In the case of a retrieval, he can connect his PACS (picture archiving and communication system) via teamplay with the so-called PACS call-up functionality. With teamplay Dose, the right patient data is automatically detected and opened in PACS. This allows for factors such as patient shape and image quality to be checked and adjusted if necessary. "As we have a reputation for HIV-associated issues of lung function and we advertise low-dose CT scans of the thorax, I regularly use teamplay to check whether we are where we want to be in regard to the results of our low-dose protocols. teamplay lets me know how I perform in any given CT exam. It gives

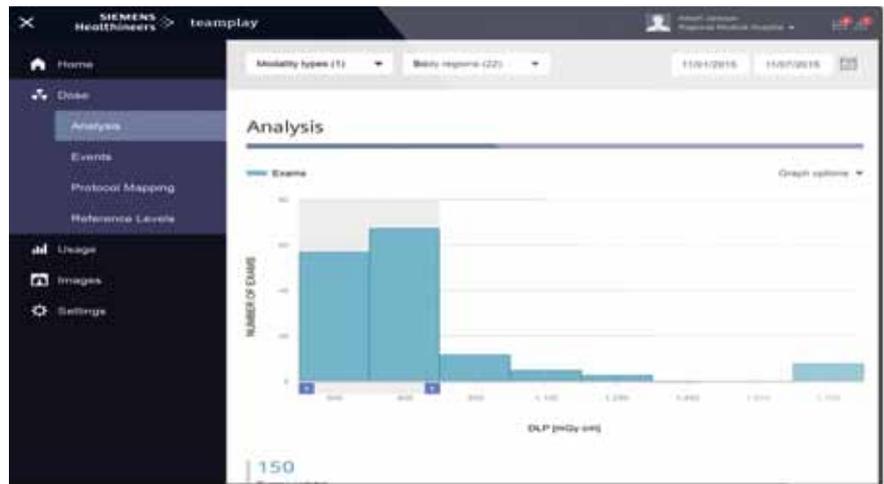


Fig. 2: teamplay Dose provides easy access to current data and allows further analysis e.g., by modality and body part for continuous dose management.

substance to my feeling about the performance based on true data filed from PACS and converts it into a graphic that is easy to grasp." As Schellhammer points out, teamplay's data-mining function is especially helpful as it uses real data from the modality itself. "It isn't calculated data and is therefore very reliable," he says. In terms of quality management, Schellhammer sees an immense advantage for patients in teamplay Dose. "We have a tool that objectifies our work. Quality management is no longer a report on a pile of paper archived in some folder. It is vivid and accessible, depicted in a graph representing information that has real substance and that I can base meaningful decisions on."

Clinical cases

Schellhammer illustrates different cases of teamplay as used in clinical routine in Cologne:

CASE 1

This case describes backtracking an outlier: "While the national reference value [2] for a head CT scan in Germany is CTDIvol 60 mGy, our examination used CTDIvol 108 mGy," Schellhammer explains. "To justify this value, we need to find the root cause," he continues.

"When checking the clinical data, I saw that we actually did three scans (a native CT scan, a CT angiogram,

and another scan post-contrast) to clarify the clinical situation. I can go deeper into the issue and double-check the indication. The issue here was impaired perfusion of the brainstem in a patient not suitable for MRI. Therefore, we fulfilled the goal of the CT scans to exclude relevant ischemia or vessel occlusion. Considering there were three examinations, we actually did well regarding dose."

CASE 2

"The national reference level [2] for a general CT scan of the thorax in Germany is CTDIvol 10 mGy, regardless of the examination. It comes as no surprise that we were over the reference value when performing a biopsy of a conspicuous structure in the lung, a circular lung focus. Such an intervention can only be partially calculated: A further rotation may be needed to access the structure. Therefore, we were fine with an increase in dose in this case. It was more important to hit the structure and confirm the pathology than to comply with dose hygiene."

Consulting and training of professionals and operators means to improve radiation dose and iodinated contrast agent performance

With this higher degree of transparency over administered dose values, continuous education of

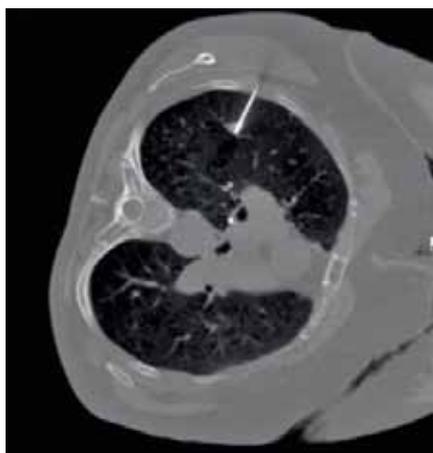


Fig. 3: Performing a lung biopsy assisted by CT imaging necessitated a further rotation to access the structure (case 2).

healthcare professionals and staff operating a range of medical equipment is one viable option to reduce dose outliers and optimize the overall dose performance. For this purpose, Siemens Healthineers offers education plans,

which can be tailored to meet specific demands. They consist of a variety of learning methods, for example dedicated workshops with a specific focus on sensible administration of contrast media in complex abdominal exams.

Another option to improve overall dose performance, are dedicated consulting programs. Optimize CARE for examples is a consulting offering from Siemens Healthineers, which provides expert insights, methodology and tools to develop a customized program for dose management in CT.

Focus increasing on contrast agent-induced radiation dose

Another lever to reduce patient exposure to radiation that receives rapidly growing attention is the ongoing critical assessment of the application of iodinated contrast agents.

This scrutiny is based on the fact that for patients at risk, insensitive application of iodinated contrast agent may

contribute to kidney damage: A study from the Philipps University Marburg (Germany) has shown that iodinated contrast agents may also amplify the effect of radiation to induce DNA damage.

One of Siemens Healthineers' consulting programs puts focus on optimizing contrast media performance in CT examinations. The program aims to advance staff knowledge and practices to achieve the clinical imperatives of new governmental guidelines and prerequisites. As a first step, the offering is designed to review and analyze the contrast media dose rates. Following this analysis, experts support healthcare staff in establishing a contrast media medication program in their clinical practice. The program is adaptable to any level of experience in contrast media management and to any size of the organization to be consulted.



Fig. 4: Siemens Healthineers' Contrast Reducing Analysis Decreasing Load & Expenses consulting program puts focus on optimizing contrast media performance in CT examinations.

REFERENCES

1. <http://www.acr.org/Quality-Safety/eNews/Issue-10-June-2015/New-Requirements>
2. Bundesamt für Strahlenschutz (Announcement of updated diagnostic reference values for diagnostic and interventional x-ray procedures) <https://www.bfs.de>
3. Intravenous Iodinated Contrast Agents Amplify DNA Radiation Damage at CT, radiology.rsna.org, Volume 275: Number 3 – June 2015

FURTHER INFORMATION

Further information on Siemens Healthineers Dose Management Approach can be found at siemens.com/right-dose

Note: The statements by Siemens' customers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption), there can be no guarantee that other customers will achieve the same results.