

Comprehensive Reporting Solution with Integrated Radiation Dose and Quality Analysis

Introduction

The reporting of examinations is an essential task for radiologists. Here, in principle, a quality assessment is possible with regard to the technical performance as well as to the probability of a diagnosis made by means of the examination in question. In principle, there is also the requirement that the findings of an examination and the dose used should be considered together.

The aim of the development was therefore the integrated presentation of the specific parameters for the X-ray dose during the reporting process and, in addition, the option of systematically recording the image quality on the one hand and the certainty of a diagnosis on the other hand with very little effort.

Methods

Structured reporting has been discussed in the radiological community for a long time and is considered essential for optimising and standardising reporting. There are numerous publications on this, including such by ESR [1].

In our hospital, a dedicated application (MRRE, Mainz Radiology Reporting Engine) was designed for structured reporting for specific examinations [2]. The following indications have proven to be particularly suitable: Cardio-CT, Polytrauma-CT, Nephro-ureterolithiasis, Pulmonary embolism, Prostate MRI, vascular ultrasound, FAST ultrasound and others. These examinations are predominantly reported with SR. In addition, all DICOM Radiation Dose SR objects from CT and angiography systems are automatically transmitted to MRRE. The corresponding values, e.g. in CT for CTDI and DLP per series and entire study, are automatically transferred to the reporting template so that the radiologist can directly recognise the dose level with which the examination was performed. Since 08/2021, an implementation of DICOM Supplement 164 for Contrast Agent Administration Reporting has been realized. Based on this, data of contrast administration will be automatically transmitted to MRRE for certain examinations and displayed to the examiner.

As part of the reporting process, 5-level scales are offered for assessing the image quality with regard to the signal-to-noise ratio and the certainty of a diagnosis [3]. The entry is optional and left to the examiner; in principle, a mandatory entry could also be technically specified for this.

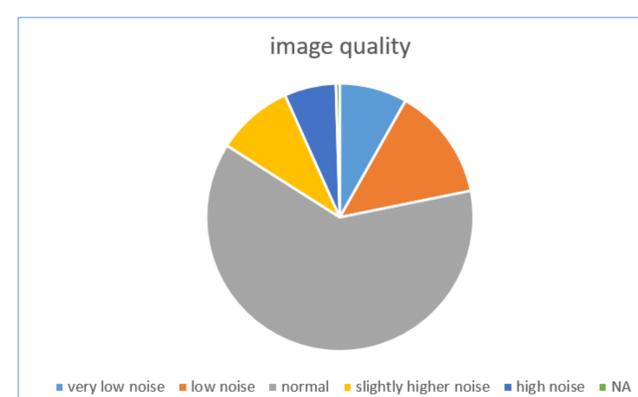
The screenshot shows a structured reporting template with several sections:

- Beurteilung:** Clinical findings, e.g., "Bipulmonale Infiltrate passend zu einer COVID-19-Pneumonie bei nachgewiesener SARS-CoV-2-Infektion."
- Dosisinformation:** A table showing radiation dose parameters for different acquisition protocols. A red arrow points to the CTDI value of 6 mGy in the 4th row.
- Performed Imaging Agent Administration:** A table showing contrast agent administration details. A yellow arrow points to the iodine concentration of 370 mg/ml.
- Image Quality:** A scale for assessing image quality. A green arrow points to the "normal" option.

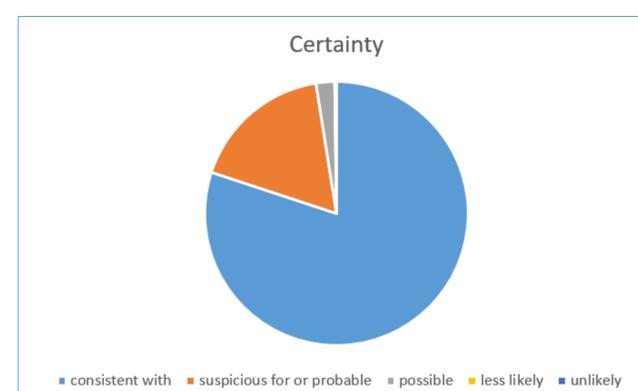
Image 1: Section of the reporting template with integrated display of radiation exposure, subdivided according to topogram, locator, bolus tracking and actual examination series, here with CTDI of 6mGy (red arrow); the display of contrast medium used and applied volumes, here with biphasic bolus of a total of 69ml KM and 31ml NaCl solution (yellow arrow) as well as two scales for assessing reliability of findings and image quality (green arrow).

Results

The solution has been used routinely for over a year in more than 5000 examinations (incl. US, MRI, etc.). In 2021, 521 CT examinations were assessed using the quality assessments. In terms of image quality, 63% of the examinations were rated as normal signal-to-noise level, while 14% were classified as low and 8% as very low noise. The proportion of examinations with increased or very increased noise was 9 and 6% respectively.



Regarding the certainty of a diagnosis, 80% of the examinations were rated as consistent, while 18% were classified as "suspicious for or probable", 2% as "possible" and only 4 cases as "less likely".



The results allow a dedicated work-up of e.g. cases classified as very low-noise or very noisy - especially to identify individual examination protocols that might have a tendency in one direction. In the examined collective, however, the extreme ratings appeared to be roughly equally distributed, with no particular tendency of over- or underexposure.

Conclusion

The application of reporting solutions allows an easy integration of evidence-based measurement values via the use of DICOM SR objects in order to obtain a holistic view of information relevant to the examination.

In the current implementation, this has been successfully realised for dose exposure as well as contrast agent application.

The acceptance for the documentation of quality parameters has proven to be relatively good in routine use and allows extensive evaluations based on this.

Literature

1. ESR. ESR paper on structured reporting in radiology. Insights into Imaging 2018;9(1):1-7. doi: 10.1007/s13244-017-0588-8
2. Pinto Dos Santos D, Klos G, Kloeckner R, Oberle R, Dueber C, Mildenerger P. Development of an IHE MRRT-compliant open-source web-based reporting platform. Eur Radiol 2017;27(1):424-430. doi: 10.1007/s00330-016-4344-0
3. Panicek DM, Hricak H. How Sure Are You, Doctor? A Standardized Lexicon to Describe the Radiologist's Level of Certainty. American Journal of Roentgenology 2016;207(1):2-3. doi: 10.2214/AJR.15.15895