

Workflow für eine DICOM- Anbindung an ein robotergestütztes Nadel- Positioniersystem

Workflow for a DICOM Connection to a Robot-Assisted Needle Positioning System

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Purpose

The purpose of this project was to develop a straightforward workflow to attach an existing robot-assisted needle positioning system to a CT scanner by implementing a DICOM connection. The system is used within the scope of interventional radiology for interventions which demand an accurate placement of a needle e.g. during punctures/biopsies or local therapies. The requirement of a straightforward workflow consists in an efficient procedure of transferring complex image data sets. For this purpose the use of DICOM network facilities is particularly suitable.

Methods

The workflow was developed and implemented on the existing robot-assisted needle positioning system IRad [1] and evaluated with several CT scanners (Volume Zoom, Sensation 16/64, Siemens Medical Solutions).

The IRad system was integrated into a PAC (Picture Archiving and Communication) system to get access to the scanners. We implemented a DICOM network application providing verification, storage and query/retrieve services to achieve image transfer.

All procedure steps were analyzed thoroughly and we reflected the way of image handling on the IRad system to provide best possible straightforwardness for the intervention as well as maximum safety for the patient.

Results

The DICOM network application is successfully implemented as a background process and set up to receive images as soon as the IRad system is running. After acquiring images of the patient they are sent from the modality to the system.

The images are internally checked in order to inspect the consistence of patient/study/series data and are visualized after passing the test. Additionally, the images are verified by the radiologist before they are stored on the system to allow a quick review later during the intervention.

By extracting information about the location of the needle within the CT coordinates the system proposes a small region for a control scan in longitudinal direction on condition of a constant patient position [1]. A DICOM image comprising the determined scan parameter values as text information is created and sent to the modality. Thus, the number of images of a control scan series and consequentially the time of image processing is reduced enormously. Additionally, the exposure of the patient decreases significantly.

Due to documentation requirements a screenshot containing information about the final needle position is created, converted to a DICOM image and finally sent to the PAC system. After the intervention all images and patient data are removed from the IRad system since the PAC system is responsible for archiving and managing the image data.

Conclusion

By using DICOM network components we were able to form an effective workflow of image transfer between the robot-assisted needle positioning system and the modality which minimizes the additional work of image handling by an automation of most procedure steps.

Our straightforward image data flow enables an improved patient care and safety by reducing the exposure dose. At the same time a reduction of the operating time is possible which in turn decreases healthcare costs.

References

- [1] Nagel M, et. al. Risk Management for a Robot-Assisted Needle Positioning System for Interventional Radiology. CARS Proceedings, 2004, pp.549-554.