dHealth 2023
B. Pfeifer et al. (Eds.)

doi:10.3233/SHTI230030

First Clinical Experiences with the New DICOM Neurophysiology Standard

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Abstract.
Background: Exchange of EEG data among institutions is complicated due to vendor-specific proprietary EEG file formats. The DICOM standard, which has long been used for storage and exchange of imaging studies, was expanded to store neurophysiology data in 2020. Objectives: To implement DICOM as an interoperable and vendor-independent storage format for EEG recordings in the Clinic Hietzing. Methods: A pilot implementation for automated conversion of EEG data from a proprietary to standardized DICOM format was developed. Additionally, EEG review based on a central DICOM archive in a DICOM EEG viewer (encevis by AIT) was implemented. Results: More than 200 long-term video EEG recordings and over 3000 routine EEGs were archived to the central DICOM archive of the WIGEV. Conclusion: Using DICOM as a storage format for EEG data is feasible and leads to a substantial improvement of interoperability and facilitates data exchange between institutions.

Keywords. Standardization, DICOM EEG, EEG, interoperability, neurophysiology

1. Introduction

Exchange of electroencephalography (EEG) data between different institutions and their archiving is complicated due to vendor-specific proprietary EEG file formats. Because of that, scientific collaboration is difficult and EEG recordings must be repeated when patients switch caregivers or are referred to tertiary centers. Consequently, there is a clear need for a standardized and interoperable solution for storing EEG data. The digital imaging and communication in medicine (DICOM) format has long been used for storage and exchange of imaging studies. In 2020, an initial set of standards for storing neurophysiology data in DICOM has been published [1, 2]. A pilot project "EEG2DICOM" to implement that standard for the first time was launched in 2019 by the Austrian Institute of Technology (AIT), the Department of Neurology, Clinic

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Hietzing, Vienna Hospital Association (WIGEV) and Sigma Software Solutions OG (Sigma) [3].

2. Methods

An automated conversion routine was implemented by Sigma that periodically imported EEG recordings available in a proprietary format from the vendor EEG archive, converted them to DICOM EEG and stored them in WIGEV's central DICOM archive. Furthermore, DICOM EEG data were linked to the electronic health record (EHR) and the EEG viewer encevis by AIT was extended to read and display DICOM EEG.

3. Results

The proposed DICOM conversion workflow was successfully set up at the Clinic Hietzing based on existing DICOM infrastructure. More than 200 long-term video EEG recordings and more than 3000 routine recordings including synchronized video as well as annotations were successfully converted. DICOM EEG files could be retrieved from WIGEV's central DICOM archive via the EHR interface and could be viewed and analyzed using encevis. Once the conversion routine was set up, new EEG recordings in the Clinic Hietzing were periodically converted to DICOM EEG.

4. Discussion

Our project marks the world's first clinical implementation of the DICOM standard for neurophysiology data and demonstrates how using standardized and interoperable file formats can facilitate collaboration across institutions as well as improve patient care. Existing DICOM infrastructure in the WIGEV facilitated implementation, and furthermore maintenance requirements were low once the periodic conversion routine was set up. Currently, the implementation is limited to the Clinic Hietzing. Undoubtedly, a successive rollout to all WIGEV hospitals would further benefit collaboration and effective patient treatment while also potentially saving costs in the healthcare system by reducing redundant EEG recordings. Using DICOM as an archiving format for EEG data has also just recently been proposed and endorsed by the International Federation of Clinical Neurophysiology and International League Against Epilepsy [4].

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