

A Visual Analytics Dashboard to Summarize Serial Anesthesia Records in Pediatric Radiation Therapy

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Introduction: Children undergoing radiation therapy require daily sedation or general anesthesia for the duration of their treatments.[1] Patient position is paramount to allow precise targeting of the radiation beam which is then replicated during subsequent treatments. The user interface of the electronic health record can hinder reviewing serial anesthesia records. We designed a visual analytics interface that simultaneously displays data from multiple anesthesia encounters.

Methods Documentation in the electronic health record (EHR, Epic Systems, Verona, WI) is backed up in a clinical data warehouse on a daily basis. A visual analytics interface (Qlikview, QlikTech, Radnor, Pennsylvania) was built to aggregate data from all anesthesia encounters in pediatric radiation oncology at The Children's Hospital of Philadelphia. The display includes the patient schedule, medications administered, airway device used, radiation procedure completed, recovery room time and agitation scale. The application was embedded in the EHR's anesthesia module and automatically updated daily.

Results: The dashboard was divided into four sections with icon legends: medications, airways, procedures, and recovery score and time. Each anesthesia encounter is represented by a vertical line with the date at the bottom of the screen. The medication icons display dosing information when the mouse cursor hovers over an icon. The airway section shows icons for endotracheal tube (ETT) or laryngeal mask airway (LMA) and a number to denote the size of the

device (e.g. a green circle with 1.5 represents a size 1.5 LMA). The procedures section shows the various procedure types including CT simulation (CT-SIM), conventional radiation therapy (XRT) and proton radiation therapy (PROTON). The “days between” represents the number of days between the current and previous anesthetic.

The patient displayed underwent one course of radiation therapy finishing in 2017, and then began another course of radiation therapy 352 days later. The recovery score and time section includes “Time to Phase 2” representing the duration of the initial recovery phase from anesthesia in minutes. The delirium scale shows the patient’s maximum recovery score based on the Watcha scale (1- calm, asleep, 2- calm, can be consoled, 3- crying, cannot be consoled, 4- thrashing and inconsolable).[2] The dashboard was incorporated into the pediatric radiation therapy team’s daily morning huddle.

Users can identify patterns and changes more readily in a summary view. For example, in the case displayed, both ETTs and LMAs were used. The ETT sizes correspond to LMA sizes (LMA 2 instead of size 2.0 ETT) representing user data-entry error. This type of error led us to re-design the user interface for airway device documentation in order to minimize user data-entry errors.

Discussion: The dashboard provides a high-level summary of all radiation therapy anesthesia records for children receiving recurrent treatments. In this clinical scenario, it is desirable to replicate an optimal anesthetic approach each day or to adjust the anesthetic based on observed patterns. In the future, we will continue to develop this dashboard to summarize multiple anesthesia records for other patient populations.

References

1. McFadyen, J. G., et al. (2011). "Sedation and anesthesia for the pediatric patient undergoing radiation therapy." *Current Opinion in Anaesthesiology* 24: 433-438.
2. Watcha, M. F., et al. (1992). "Perioperative effects of oral ketorolac and acetaminophen in children undergoing bilateral myringotomy." *Can J Anaesth* 39(7): 649-654.

Figure 1

