

One Laryngospasm, Two Realities: The Impact of Data Granularity on Post Hoc Analysis of Perioperative Events

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Background: Anesthesia information management systems (AIMS) record perioperative data in an automated fashion. Secondary uses of AIMS data include research and quality improvement efforts. Concerns, however, have been raised regarding data validity and artifacts in AIMS. This case highlights how different data sampling rates can significantly alter the analysis of perioperative events. Physiologic monitors can be configured to transmit data directly to an AIMS or a middleware medical device interface (MDI). AIMS and MDI data sampling rates can vary. For example, our institution’s AIMS has a sampling rate of 1 minute, while our MDI stores most physiologic data at higher rates depending on the monitor. Monitors with a high sampling rate such as the pulse oximeter are stored at much shorter time intervals (every 10 sec) in the MDI, as opposed to a 1-minute interval in the AIMS.

Case Description: A 21-month old child presented for surgery. During induction of anesthesia, the patient experienced acute airway obstruction consistent with laryngospasm, and the anesthesiologist immediately intervened with a jaw thrust, approximately 30cm H₂O of positive pressure ventilation, and succinylcholine. The obstruction resolved quickly and the remainder of the anesthetic was uneventful.

The AIMS and MDI data recorded during the obstruction event was later reviewed. The AIMS data with 1-minute intervals did not display sustained high inspiratory pressures, while the higher granularity MDI data showed the use of high pressures (Figure 1a). The MDI data showed the SpO₂ dropped transiently below 60%; the AIMS data displayed only a brief SpO₂ nadir that stayed above 85% (Figure 1b). In contrast, the end-tidal CO₂ levels are more similar in the MDI and AIMS data, likely due to the slower MDI sampling time for that parameter (Figure 1c).

Discussion: This case highlights the impact of data sampling rates and granularity on the post hoc interpretation of perioperative events based solely on physiological data. In pediatric anesthesia, events such as laryngospasm can be extremely brief and perioperative data that are sampled every 60 seconds may not accurately represent the actual physiologic

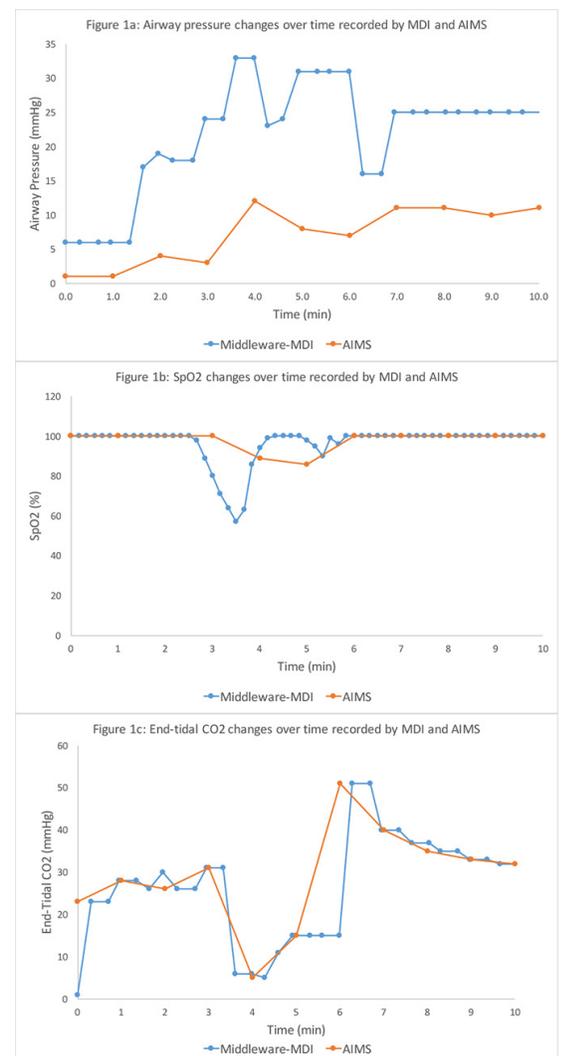


Figure 1: Airway pressure, SpO₂, and End-tidal CO₂ changes over time recorded by the medical device interface (MDI) and anesthesia information management system (AIMS).

changes. Unfortunately, not all hospitals have the financial and technological resources to implement high fidelity MDI systems and store the large amounts of higher granularity data. However, if higher granularity MDI data is available, then such data should be examined alongside AIMS data and clinicians' annotations to obtain a more accurate view of perioperative events. While AIMS have come a long way as perioperative data recording systems, there still exist some potential pitfalls that should be kept in mind when relying on AIMS data for research and quality improvement efforts.