

Electronic Health Record Artifact Caused by Surgical Diathermy

Shallik N^{1,2,3*}, Zaghw A¹, Ramachandran B¹, Hammad Y^{1,2}, Ganesan S⁴ and El-Menyar A^{5,6}

¹Anesthesia, ICU and Perioperative Medicine, Hamad Medical Corporation, Doha, Qatar

²Clinical Anesthesia, Weill Cornell Medical School, Doha, Qatar

³Anesthesia and SICU, Faculty of Medicine, Tanta University, Egypt

⁴ORL-HNS department, Hamad Medical Corporation, Doha, Qatar

⁵Clinical Research, Trauma and Vascular Surgery, Hamad Medical Corporation, Doha, Qatar

⁶Clinical Medicine, Weill Cornell Medical School, Doha, Qatar

*Corresponding author: Nabil Shallik, Assistant Professor of Clinical Anesthesiology at Weill Cornell Medical College in Qatar, Doha, Qatar, Tel: +974-555439264; E-mail: Nshallik@hamad.qa

Received date: July 26, 2018; Accepted date: August 08, 2018; Published date: August 14, 2018

Copyright: © 2018 Shallik N, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Electrical devices used in the clinical setting can induce artifacts by various different mechanisms. We aimed to present an example of serious artifact happened during induction of general anesthesia in a child. With the advent of newer surgical technologies and more advanced anesthesia and surgical equipment in the operating room, we are expecting the interference could be an issue, if it is not taken into considerations in advance. Healthcare provider should be aware about this incident and its management.

Keywords: Electrical devices; Artifact; Monitoring tools; Medical records

Introduction

Electronic patient record is now a standard of care in the operating room, the intensive care unit (ICU) and other departments in many hospitals.

Artificial signals, which could corrupt the normal electronic recordings, may arise from external sources. Electrical devices used in the clinical setting can induce artifacts by various different mechanisms. Newer diagnostic and therapeutic modalities may unpredictably generate few but significant artifactual changes.

These artifacts may be nonspecific or may resemble serious complication in terms of adding or removing new parameters or new drugs, and closing or opening some new windows when using anesthesia management software “Cerner electronic system”.

Technological advancements in processing the electrocardiographic (ECG) signals may be useful to detect and eliminate machine artifacts. Ultimately, understanding of the artifacts generated by devices, and their identifying characteristics, is important to avoid misinterpretation, misdiagnosis, and unpredictable complications.

Here we present an example of such unexpected artifact in anesthesia charting software that appeared during maintenance of general anesthesia in a child.

Case Presentation

A 4-year old child was posted for adeno-tonsillectomy under general anesthesia. The child was connected to a basic monitor (ECG, peripheral capillary oxygen saturation, blood Pressure and endotracheal CO₂).

Inhalational induction was commenced using Sevoflurane, then IV line, Propofol 1 mg/Kg plus Fentanyl 2 mcg/Kg and connected to anesthesia machine. Anesthesia record was commenced using Cerner software application. A pediatric anesthesia macro was selected, a setup that contains drugs, actions, fluids intake, monitoring vital signs and anesthesia machine parameters.

When the surgeon started to use diathermy (Figure 1), we noticed an ECG changes (Figure 2), in addition to strange changes including opening new, or closing existing Microsoft windows, adding new drugs not given or ordered to the child’s anesthesia chart, and some actions were deleted from electronic anesthesia record (Figure 3).



Figure 1: Diathermy (Curis Sutter Medizintechnik tullastraBe 87-79108 Freiburg/ Germany).



Figure 2: ECG changes with diathermy.

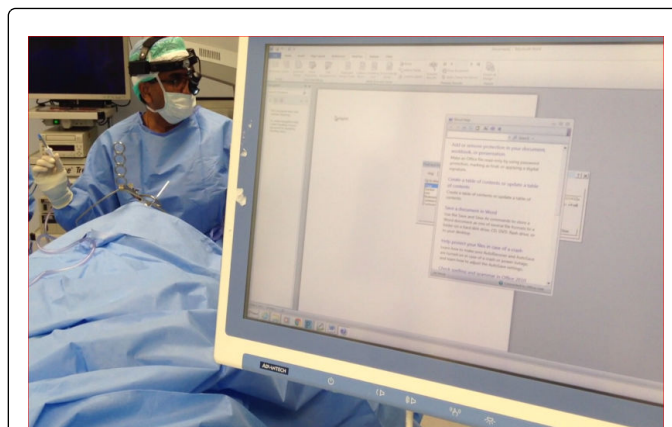


Figure 4: Opened Microsoft word document artifacts with diathermy.

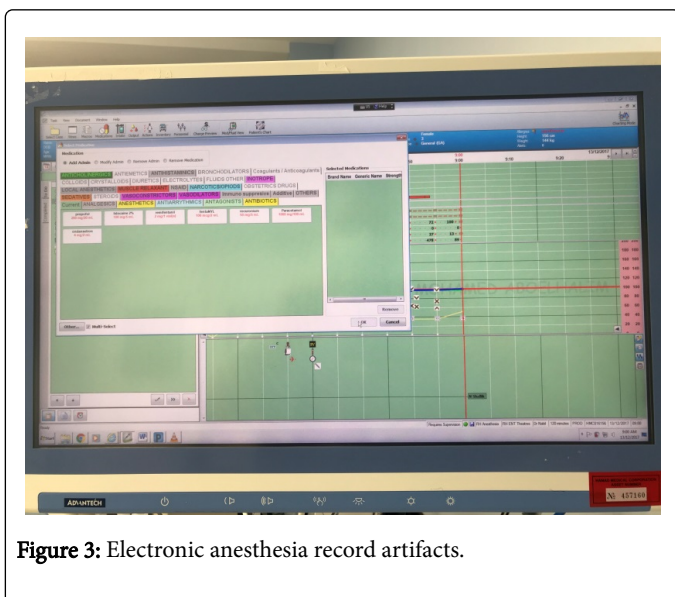


Figure 3: Electronic anesthesia record artifacts.

We tried to open the word file document and to analyze the artifacts and track its sources. At this time, we found that alphabetical letters were typed randomly on one of the spontaneously opened Microsoft Word file as artifacts during using surgical diathermy. The spontaneous typing was related to surgical diathermy and has stopped whenever the surgeon stopped using it (Figure 4).

We tried to change the ground pad connected to the child, but we found the same problems recurred. Also, we changed the diathermy settings from unipolar to bipolar but we still noticed the same errors. All options were changed like diathermy power, diathermy position in relation to patient, connecting wires, anesthesia machine position and diathermy handle. All these steps were unsuccessful to stop the spontaneous erroneous data entry.

The computer use was scanned to detect any virus; worm or software problem but we did not find any offender. We have noticed that this problem happens whenever we have a new diathermy machine added to the operating theatre. Therefore, we sought to change the diathermy machine and no further artifact was noticed.

Discussion

Electrical interference is the noise or the artifact that occurs during signal acquisition. It is a well-known phenomenon that may occur in anesthesia practice using monitoring devices. Electrical interference has been reported to occur with pulse oximetry, ECG and Bispectral Index monitoring [1]. The physiological signal acquisition has many limitations, as the physiological signals are very tiny and on the top of the surrounding potential noise ranging from skin capacitance effect to high energy electrical equipment. The electrical interference occurs due to electromagnetic coupling in the recording wires that eventually distort the physiological signals and increase the noise to signal ratio, leading to artifacts [2]. The electromagnetic coupling could be by inductive, capacitive or radiative coupling.

The inductive coupling is due to moving of the electrode wire in a magnetic field that induces electricity through the wire, more common in MRI settings. The capacitive coupling occurs at patient's skin surface as it acts as an electrical capacitor "antenna" which amplifies the electrical energy. Also, the skin of operating room staff, especially surgeons, can augment the electromechanical coupling of the patient's skin [3]. So the interaction among the skin charges with mechanical movements of recording electrodes and lead wires can reflect as a motion artifact in the physiological signals. The main source of interference is the Electrosurgical unit, however the surgical headlamp, fluid warmer, and patient air warmer, however, any other electrical equipment has been reported to be potential sources as well.

Certain measures should be taken to minimize the interference from electrical surgical unit. It has been recommended that not to plug the electrical surgical unit in the same socket with the anesthesia equipment, installing the grounding plate as near as possible to surgical field and attaching the monitor probes as pulse oximetry as far as possible. Routing the grounding plate wire away from the monitor wires is necessary. In general, it is the role of anesthesiologist to secure and monitor the attachment of the electrodes as any dislodgment could increase the skin impedance dramatically [3]. In summary, the power wires of anesthesia and surgical equipment should be as far as possible from the monitor electrodes, data transferring cables and connecting wires [4]. Such measures could help to minimize the electrical interference when the physical proximity of the wires could be a

concern, but there has been no recommendation so far for the interference that could affect the software or electronic anesthesia chart.

Conclusion

With the advent of newer surgical technologies and more advanced anesthesia and surgical equipment in the operating room, we are expecting the interference could be an issue, if it is not taken into considerations in advance.

References

1. Patel SI, Souter MJ (2008). Equipment-related electrocardiographic artifacts: causes, characteristics, consequences, and correction. *Anesthesiology* 108: 138-48.
2. Marquez MF, Colin L, Guevara M, Iturralde P, Hermosillo AG (2002) Common Electrocardiographic Artifacts Mimicking Arrhythmias in Ambulatory Monitoring. *Am. Heart J* 144: 187-197.
3. Baranchuk A, Shaw C, Alanazi H (2009) Electrocardiography Pitfalls and Artifacts: The 10 Commandments. *Crit Care Nurse* 29: 67-73.
4. Knight BP, Pelosi F, Michaud GF, Strickberger SA, Morady F (1999) Clinical Consequences of Electrocardiographic Artifact Mimicking Ventricular Tachycardia. *N Engl J Med* 341: 1270-1274.