RESEARCH TOPIC CLI20

Improving ventilation outcomes through machine learning analysis of high granularity data (I-VENT study)

Research Area

Services Area

Clinical Unit name

Anesthesia and Intensive Care, IRCCS Humanitas Research Hospital

Supervisor

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Abstract

Mechanical Ventilation (MV) is one of the most frequent treatments in intensive care units (ICUs). Altough MV is frequently employed as a lifesaving measure in cases of acute respiratory failure, its utilization may lead to complications during both the acute phase of respiratory failure and in the weaning phase. Specifically, PVAs are frequently observed in the weaning-recovery stages of Acute Respiratory Failure, and are associated with lung damage, delayed weaning from MV, and unfavorable outcomes. Currently, there are no established methods for consistently monitoring and detecting of PVAs. PVAs are generally detected by human bedside evaluation of ventilators' waveforms, a time-consuming process which is by definition limited in time. Recently, Machine learning (ML) methods, such as Neural Networks, have been suggested for the purpose of waveform analysis. These techniques aim detect and classify autonomously the various types of waveforms. Our group recently conducted a pilot research that utilized machine learning approaches to identify and categorize asynchronies in patients on mechanical ventilation, with data. Object of this PhD program is to further proceed on respiratory waveform analysis for recognition and classification of PVAs, with the underling scope of 1) further validate the algorithm for detection and classification of PVAs 2) develop and test real time detection of classification, comparing ML performance with trained healthcare professionals 3) develop new ML models for prediction of weaning success which will incorporate real-time detection of PVA along with other data derived from respiratory and Electronic Health Record.

Scientific references

Greco M, Angelotti G, Caruso PF, Zanella A, Stomeo N, Costantini E, Protti A, Pesenti A, Grasselli G, Cecconi M; Lombardy ICU Network. Outcome prediction during an ICU surge using a purely data-driven approach: A supervised machine learning case-study in critically ill patients from COVID-19 Lombardy outbreak. Int J Med Inform. 2022 Aug;164:104807 PMID: 35671585;

Caruso PF, Angelotti G, Greco M, Guzzetta G, Cereda D, Merler S, Cecconi M. Early prediction of SARS-CoV-2 reproductive number from environmental, atmospheric and mobility data: A supervised machine learning approach. Int J Med Inform. 2PMID: 35390590

Greco M, Caruso PF, Cecconi M. Artificial Intelligence in the Intensive Care Unit. Semin Respir Crit Care Med. 2021 Feb;42(1):2-9. doi: 10.1055/s-0040-1719037. Epub 2020 Nov 5. PMID: 33152770.

Caruso PF, Greco M, Ebm C, Angelotti G, Cecconi M. Implementing Artificial Intelligence: Assessing the Cost and Benefits of Algorithmic Decision-Making in Critical Care. Crit Care Clin. 2023 Oct;39(4):783-793. doi: 10.1016/j.ccc.2023.03.007. Epub 2023 Apr 26. PMID: 37704340.

Type of contract

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