Artificial Intelligence and Machine Learning Current and Potential Use in Anaesthesia

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Editorial

The condition of unconsciousness is inferred by anesthesiologists in modern practise rather than the brain being directly observed. Electroencephalographic (EEG) signs of anesthesia-induced unconsciousness have been previously found, and these signatures are drug- and patient-specific. To build classification models for real-time monitoring of the unconscious state during anesthesia-induced unconsciousness, we used machine learning techniques. Using 33,159 2s segments of EEG data from 7 healthy volunteers who were given increasing propofol infusions while responding to stimuli to directly measure unconsciousness, we utilised cross-validation to identify and train the top performing models. When assessed on 13,929 2s EEG segments from 3 left-out subjects gathered under the same circumstances, cross-validated models of unconsciousness showed excellent performance (median volunteer AUCs 0.99-0.99).

When tested on a cohort of 27 surgical patients receiving only propofol, collected in a separate clinical dataset under various conditions and using different hardware, the models demonstrated strong generalisation (median patient AUCs 0.95–0.98), with model predictions correlating with the anesthesiologist's actions during the cases. 17 patients taking sevoflurane (alone or in combination with propofol) performed well as well (median AUCs 0.88–0.92). These findings suggest that EEG spectrum properties can predict unconsciousness even when evaluated using an anaesthetic that uses a different brain mechanism but is similar in its effect. We can precisely track the anaesthetic state using high performance predictions of unconsciousness, and this method could be utilised to design infusion pumps that can understandably react to patients' cerebral activity.

Most surgeries are done while the patient is asleep (GA). The drug-induced, reversible condition includes antinociception, unconsciousness, amnesia, and immobility while physiological stability is maintained. By giving patients mixtures of intravenous and/or inhaled anaesthetic, analgesic, and muscle relaxing medications, anesthesiologists can produce and sustain this state. Anesthesiologists typically monitor a patient's physiological indicators to determine the patient's state of unconsciousness during surgery (e.g., blood pressure, heart rate, respiratory rate, movement and perspiration). Literature to help us better understand how new technology are used during surgery; in particular, we concentrate on the management and administrative Operating Room (OR) perspective. Studies carried out on patients over the age of 18 between 2015 and February 2019 were considered eligible. There were 19 papers included in all.

According to our analysis, there are numerous potential applications for machine learning (ML) in the subject of OR organisation. Predictions of the surgical case time were successfully obtained; as a result, their use could enable more exact scheduling, reducing resource waste. As in the case of the post-anesthesia care unit and operating rooms, more complex models that can coordinate numerous locations at once can be supported by ML. Other organisational issues, including cancellation, which have significant financial effects, might be restricted using various forms of artificial intelligence. The use of Random Forest has shown to be successful in identifying surgeries with high cancellation risks, allowing for the planning of appropriate preventative actions to lower the cancellation rate. Conclusion: Although there is still a lack of data in the literature, we believe that ML has significant potential for organising the OR; nonetheless, more research is required to determine the usefulness of these new technologies in perioperative medicine. Medical diagnostic, therapeutic, and intervention-based applications have been made possible by the rapid advancements in artificial intelligence (AI). Currently, there is a significant gap between research publications based on AI and their application to clinical anaesthesia, which needs to be closed.

The most frequently used branch of AI in medicine is machine learning (ML), which gives computers the ability to continuously learn while analysing massive amounts of data, identifying relationships, and forecasting results. It entails the development, testing, and analysis of algorithms with the capacity to carry out cognitive processes such association between variables, pattern recognition, and outcome prediction. For the pharmacological maintenance of anaesthesia and hemodynamic management, AI-supported closed loops have been developed. Mechanical robots can precisely conduct dexterity- and skill-based activities like intubation and regional blocking, whereas clinical decision support technologies may complement the work of the doctor in emergency scenarios.

Although there are countless possibilities, widespread AI adoption is still a long way off. The gathering, validation, transfer, and testing of patient-related "Big Data" are under ethical review. We searched PubMed in 2020–2020 and found literature on AI and anaesthesia for this narrative review. We wrote the review after giving the material a lot of thought in order to emphasise the growing significance of AI in anaesthesia. Clinicians should start by becoming aware of and comprehending the fundamentals of AI. We have highlighted key elements of ongoing AI research on anaesthesia and perioperative care [1–5] in our narrative review.

Conflict of Interest

Author declares no conflicts.

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