Editorial

Artificial Intelligence and Anesthesia

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The introduction of new drugs, equipment, techniques and technologies in the anesthesia practice has seen significant advancements in recent years. To date, various innovations including in anesthesia and surgery are available.[1] An advance in medical technology has revolutionized the way health care is distributed to the patients. Artificial intelligence (AI) and telemedicine have been used for a variety of medical services. Interestingly, the spread of the coronavirus disease (COVID-19) pandemic has given an enhancement to the adoption of telemedicine worldwide.[2] AI is the science of building computer systems that can imitate the human intelligence. Several previous reviews indicated that AI-enabled decision support systems, when implemented appropriately, could assess in enhancing the patient safety by improving error recognition, patient stratification and drug management.[3]

The numerous subsets of AI include machine learning (ML), neural network, deep learning, robotics and computer visualization.[4] ML is now regarded as a mature technology and is employed in many industries for the quality control, error detection and product recommendations. Several ML models have been developed to response the applicable clinical questions by using representative data such as using perioperative data to predict postoperative mortality and postinduction hypotension by analyzing preoperative and induction data.[5] A robot is a mechanical system capable of interacting with the environment according to directed interventions. The first mechanical robot for tracheal intubation was done by using the Da Vinci surgical system. Simulated fiber-optic-assisted oral and nasal intubations of a manikin were successful but technically difficult.[6] For regional anesthesia, the Magellan system has been developed with a block needle mounted on a robotic arm and been integrated software for ultrasound-guided nerve identification.[7]

AI improves the clinical practice of anesthesia in a variety of systems including perioperative support, critical care delivery and pain management. The potential uses of AI in anesthesia can be schematically grouped into clinical decision support and pharmacologic and mechanical robotic applications. Tele-anesthesia includes strategies of telemedicine, as well as device networking, for improving logistics in the operating room, and improved certainty approaches for training and assistance.[8] One of the most talented applications of AI in anesthesia is the development of predictive models that can identify the patients at risk of complications during surgery. For pre-anesthetic evaluation, AI has been employed for airway assessment and correctly predicted

the Cormack-Lehane view with examination of face and neck.[9] Intraoperative cognitive robots could be integrated into alarm systems for simultaneous analysis of several parameters.[10] Subsequently, AI algorithms can analyze the patient data and assist the pain physicians in identifying the pain-related conditions more accurately. In addition, AI can also assist in the monitoring of patients during the operation. These systems could alert the anesthesiologists to potential issues before they become critical.

Several applications of AI in anesthesia include the depth of anesthesia monitoring, control of anesthesia, the event and risk prediction, ultrasound guidance, pain treatment, and the operating room management.[11] An application of AI in anesthesia is the optimization of drug dosages. AI algorithms can analyze patient data including age, weight and medical history, to predict the optimal dosage of anesthetic drugs. Moreover, AI can also help anesthesiologists make more informed decisions during surgery, which can help reduce the risk of complications and improve patient outcomes. Furthermore, it can reduce the workload of anesthesiologists. AI also helps to improve the operating room management, which can decrease the costs and improve the efficiency. Advances in telecommunication have led to the development of wireless intelligent patient-controlled analgesia for feedback-permitted pain management in the surgical homes.[12] In critical care, AI applications are in the early phases of development and further studies are still needed.[13]

However, AI is also potential disadvantages that need to be considered. One of the main disadvantages is the absence of data. AI relies on large amounts of data to make accurate predictions, but there is a scarcity of high-quality data in anesthesia. This makes it difficult for AI to make accurate predictions and recommendations. Another potential problem is the lack of standardization in anesthesia practice. Generally, anesthesiologists use different techniques and protocols, which can make it difficult for AI to make the accurate predictions. Importantly, anesthesiologists needed to be aware of the limitations of AI and be prepared to ensure the intervention.

Moreover, the integration of AI in anesthesia also raises the ethical and legal questions. To address these issues, it is essential to create the guidelines and regulations for the use of AI in anesthesia. This includes warranting that AI systems are transparent and explainable. It also means establishing clear outlines of responsibility and accountability for the use of AI in clinical settings. One of the ethical challenges in implementing AI based ML in anesthesia is the matter of data privacy and confidentiality as well as the potential bias in algorithms. ML requires large amounts of data to train algorithms and make accurate predictions. However, the use of patients' data without their informed consents or knowledge is the violation of privacy and confidentiality. Therefore, it is important to establish clear policies on data access, storage, and distribution.

Additionally, there is an apprehension of substituting the human expertise with AI. Although AI can assist in the decision making, it cannot replace the expertise and judgment of human anesthesiologists. It is important to confirm that the use of AI in anesthesia is

complementary to human expertise and not a substitute for it. This can be achieved by providing adequate training and education on the use of AI to anesthesiologists and also ensuring that they are involved in the development and implementation of ML algorithms. To date, the issues of accountability and responsibility arise when using ML in healthcare.

In case of adverse events or mistakes, AI may be difficult to determine who is responsible, the AI algorithm or the human operator. Therefore, clear protocols and guidelines need to be established for the use of ML in anesthesia, and accountability should be shared between the algorithm and the human operator. Anesthesiologists hold a range of opinions, both positive and negative, regarding the application of AI in their fields of work. An engagement with specific concerns, both technical and ethical, will verify important as this technology moves from research to the clinic.[14] The success of AI in anesthetic management is dependent on the collaborative work among the institutions caring for various communities. The strict regulatory environment is a significant barrier for adoption of AI, which varies by country and institution. Several algorithms are now considered software as medical device to promote the safe innovation and to preserve the patient safety.[15]

In conclusion, the use of AI technologies could critically evaluate every aspect of perioperative medicine and devise innovative value-based solutions that can potentially improve the patient safety and care delivery, while optimizing cost of care. The integration of AI in anesthesia has the potential to transform the field and improve the patient outcomes. However, it is essential to address the ethical and legal implications of using AI in clinical settings. AI systems must be designed to prioritize patient safety and well-being, and to respect the patient privacy and confidentiality. By developing guidelines and regulations that prioritize patient safety and well-being, anesthesiologists could ensure that AI is used in a responsible and ethical manners.

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