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EDITORIAL VIEW

Artificial intelligence--- Future of Anesthesiology!!

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ABSTRACT

The term artificial intelligence (AI) was introduced in 1950. There have been many attempts to develop machines capable of performing cognitive and skill based tasks of anesthesiologist based on the principles of AI. These attempts have not been successful because of the complexities of anesthesia practice. Recent innovations in AI, especially machine learning, will continue to grow in importance in the years to come and will greatly revolutionize the face of anesthesia along with surgical practice, perioperative medicine practiced in clinics, and imaging interpretation. Anesthesiologists should continue to embrace this technology, stay up to date with the advances in AI, and also make genuine efforts to smoothly assimilate it in their routine practice now so that they can be the revolutionaries of their own future. We hope to see an ever-widening spectrum of the uses of AI in all fields of medical practice, and anesthesiology is not an exception. Its time our friends start visualizing the many applications of AI in their practice.

Key words: Anesthesiology; Artificial intelligence; Machine learning

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The machine capability to respond in a manner similar to human intelligence is commonly known as 'artificial intelligence' (AI). The term is used to describe machines that mimic "cognitive" functions, which humans associate with their mind, such as "learning" and "problem solving".[1]

AI has already made big inroads into our daily life for some time now. Smart phones now have the ability to vocally direct us to our destination through mazes of highways and traffic. The fact that self-driving cars are currently in advanced testing phases doesn't faze us anymore. AI systems have seeped steadily everywhere and ingrained themselves as an integral part of our routines in such a way that we even do not notice their presence. John McCarthy, who introduced this term in 1950 stated at that time that "As soon as it works, no one calls it AI anymore".[2]

Conceptually, AI at the moment can be categorized into two types: restricted and general or simply, the weak and strong. The term 'conceptual' is being used for now, as systems with limited AI only are in existence at the moment. Limited is perhaps a way more accurate term as it clearly infers that the extent of the technology is restricted and not that it lacks the ability to carry out an allocated task well within its designated area. Much like a child growing up, the learning curve of a limited intelligence system are ever-evolving and increasing vastly. Predictions of a future where such an AI system will become a highly integral part of everyday life have already been circulating. There will be no escaping, as it fully embeds into our daily lives. The long-term goal for AI developers at the moment is to perfect artifcial general intelligence and create the ultimate strong AI. A system like this would potentially be infused with superior intelligence and have reasoning capabilities that would greatly outperform humans across every area in which they could acquire proficiency and expertise. For now, such a system only exists in science Fctions, like the AI system called J.A.R.V.I.S for Ironman/Tony Stark or in Wanda.

AI systems in medicine (AIM) will not only continue to grow in importance in the years to come, it will greatly revolutionize the face of anesthesia along with surgical practice, perioperative medicine practiced in clinics, and imaging interpretation.[3] Anesthesiologists can work on enhancing each patient's experience and individual outcome by meticulously creating and

working harmoniously with AI learning systems that develop personalized clinical guidelines, created after careful analysis of medical information available.

The question that arises in our mind is that what will happen to the field of anesthesiology once these AI machines become available for day to day usage? Anesthesiologists require the implementation of a combination of cognitive and skill based labor in their profession, and in the way development is progressing, AI is bound to lead to the automation of cognitive work. However, the aforementioned required mix of skills could potentially be the very reason to prevent complete use of automated AI systems in the specialty.

The unique skills that humans are bestowed with help the anesthetist in daily routine activities such as performing endotracheal intubation, intravenous cannulation, or nerve block procedures. However, these skill sets have just not been developed in AI based anesthesia machines. Incorporating machine learning methods and tools in AI systems prove to be greatly efficient in one very vital aspect. Evidence suggests that Clinical Decision Support (CDS) tools seem to have been highly effective for minor tasks in anesthesia, such as daily reminders for administration of antibiotics and documenting patient care notes. However, at the same time, they have also been reprimanded for not considering the needs of the individual patient because of their design. Incorporating machine learning abilities to CDS tools in the future could potentially enhance the analytical capacities of the system and highly improve upon the complexities.[4] It is practical to assume that this kind of progress may lead to creating clinical pathways that are entirely authenticated and verified, as in making sure that they are created after careful analysis of the available data at hand, as well as the personalized ones based on the requirements unique to every patient. An effective system like this will also have the ability to adapt and keep up with newly published evidence and constant research every day, and will most certainly produce new information on its own, relying on intricate scrutiny of patient information from online medical records available.

Progress like this can definitely give individual providers the cognitive edge necessary for someone to tackle the plethora of medical data efficiently. It can also help them in maintaining clinical pathways alongside in order to ensure improved outcomes for patients. We can also expect another possibility in the near future for AI-automated systems where they could execute semiautonomous anesthesia maintenance, as these are further perfected. The AI-enabled machine could take over to deliver the particulars of anesthesia maintenance, just like an airplane is controlled by an auto-pilot after a certain period.

If in the subsequent years, an entirely automated anesthesia maintenance system is in fact developed, it would most definitely have an overwhelming effect on the ebb and flow of the work patterns and the needs of anesthesiologists. While some warn that an AI-enabled automation in the workplace could lead to massive unemployment issue due to an overwhelming influx of self-reliant machines, others are optimistic for a more positive outcome. In the aforementioned scenario, outcomes predict that a greater rise in productivity could be seen if AI systems continue to work in a synergetic partnership with humans, reducing cognitive workload and enabling automation. Thus, resulting in a more productive use of effort and time for humans in other tasks. Liberation from menial tasks after delegating them to AI could allow one to focus on doctor-patient relationships and fulfill the needs, concerns and apprehensions of patients without compromising on efficiency and standard of care. Particularly when it comes to anesthesiology, innovations such as these may provide this specialty a chance to revitalize the efforts required to morph itself from a specialty restricted to the intraoperative phase to one that takes care of the entire perioperative period. Transformations such as these are already in the initial phase of keeping the focus concentrated on non-operating room territories such as management of pain and taking care of the critically ill patients.[5] Additionally, on a larger scale in the anesthesiology, specialty limited AI technology based anesthesia machine usage will expedite the delivery of anesthesia in the perioperative surgical home.[6]

In spite of a promising prospective, a number of pitfalls are frequently encountered once a machine that approaches the desirable features for clinical use is tried on real patients. The biggest obstacle so far is bringing experts together in medicine, data analytics and computer science to create and develop in harmony, the constituents from which a narrow AI system acquires the skills to deliver anesthesia. Another challenge will be vouching for the absolute effectiveness and safety of these self-automated systems. As one would carefully observe an intern, it is absolutely necessary to monitor clinical decision making abilities of the system to avoid mishaps during clinical care provision. Working diligently with the architects of AI systems will also be an essential part of being able to diagnose and remove any errors that might occur in the machine's capacity to make clinical decisions. Full disclosure of how the decisions are executed is the way to go when it comes to a system like this. However, full transparency conjures up yet another obstacle, which is security. While transparency is an essential component of the decision-making progress, measures to prevent security lapses and breaches of personal medical data must also be taken. In this age of digitalism, threats

of hacking medical devices connected to the internet are a serious hindrance to the development of AI systems.[7]

For now, the future repercussions of AI systems remain uncertain and there is no concrete solution to ascertain the outcome. However, anesthesiologists have known to be trailblazers when it comes to adopting technology and they tend to be at ease while integrating contemporary technology in order to enhance their care for their patients. They should continue to embrace this strategy, stay up to date with the advances in AI, and also make genuine efforts to smoothly assimilate them in routine practice now so that they can be the revolutionists of their own future.

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FHK - Manuscript concept, initial drafting

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