

Past, Present and Future of Artificial Intelligence in Oncoanesthesia

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Citation: Tatakuri M. (2023) Past, Present and Future of Artificial Intelligence In Oncoanesthesia. J Can Ther Res. 4(1):1-4.

Received: August 28, 2023 | **Published:** January 1, 2024

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Introduction

Overview

Artificial Intelligence (AI) is a field which combines computer science and robusts datasets to simulate the human mind. Application of Artificial intelligence has shown its extensive benefits in every aspect of medicine, whether its diagnostic or therapeutic applications [1]. Oncoanesthesiology is one such field in medicine where AI applications have been used in past, present, and is expected to play its pivotal role in the very near future. Successful integration of technology requires a good multidisciplinary team approach with the hearts and minds of clinicians. The engaged stakeholders for the AI care team may include experts, scientists, project managers, data scientists, medical subject matter and end users. The three pivotal data science concepts include:

1. Artificial intelligence: Capability of computers to respond in a manner resembling human intelligence.
2. Machine Learning; Subset of AI, that provides systems the ability to improve the experience by learning automatically without being programmed explicitly.
3. Deep Learning: Subsets of machine learning where AI networks, algorithms are incorporated into modules which are usually the data collected from human brain experience [2,3].

In April 2018, US food and drug administration approved the first software system that uses AI- a program that assists in diagnosis of diabetic retinopathy by analyzing fundus images of the eye [4]. In historical development, anesthesia was the earliest subject to implement AI. First model of pharmacokinetics/ pharmacodynamics of clinical drug administration was done through the Pk/Pd model [5-7]. Later the role of AI in present oncoanesthesia have been significantly been noticed in EEG monitoring, open and closed loop automated anesthetic delivery system and simulation training programmes. One more application of AI is the google translate which is helpful in communicating with patients in their mother tongue and hence helpful in avoiding blunders. Futuristic in oncoanesthesia may evolve in fields of Tele Anesthesia.

Applied Fields of AI in Onco-anesthesiology

1. **Depth Of Anesthesia Monitoring:** In our oncoanesthesia practice, to decrease the intraoperative awareness, commonly used modules are Bispectral Index (BIS) and Electroencephalography (EEG). Values on higher ranges suggest the patient is awake leading to postoperative morbidity and lower side values have shown a higher postoperative complications and mortality following surgeries. In Oncoanesthesia, procedures are usually long duration, complex and most of them being minimally invasive procedures, the dose adjustment of anesthetic drugs can lead to either higher or lower BIS values. AI with the help of highly sensitive integrated neural networks may predict the events earlier and hence decrease the morbidity [5-8].

Similarly, lower Mean Arterial Blood pressure has been associated with postoperative mortality. Minimally invasive oncosurgeries, head and neck onco surgeries require most of the time hypotensive anesthesia. So, based on preexisting data, electronic medical records, observational clinical trials, machine learning model by AI can have its greater impact in this field.

2. **Control of anesthetic Drug:** Similarly, to the depth of anesthesia, delivery of anesthesia, neuromuscular blockade, analgesic drugs with the help of closed loop neural network AI system helps in delivering quantifiable dosage required for the patient. 'Opioid free anesthesia' have been quiet popularly used in recent years in Oncoanesthesia. It emphasizes mainly on the concept that overt opioid usage can lead to unnecessary postoperative complications and can have its negative impact on long term survival in oncology patients. Curtailing opioids have also shown setbacks in increasing hospital morbidity. In order to increase the precise opioid usage, having explicit and precise memory helps in avoiding unnecessary complications. So, in this aspect AI by feed forward and feedback neural networks can help in better delivering required opioid safer doses.
3. **Event Prediction:** Short onco anesthesia procedures commonly performed are brachytherapy, biopsies, radiotherapy. These procedures require sedation or Monitored Anesthetic Care (MAC). Awareness during procedure, respiratory depression, depth of anesthesia can easily be predicted with AI and avoid complications.
4. **Ultrasound Guidance:** Placement of long-term venous access like chemoport securement, peripherally inserted central catheter (PICC) lines needs expertise in identification of anatomical

landmarks for smoother completion of procedure. AI uses the incorporated module with anatomical landmarks helps in correct placement in lesser time and with fewer complications. The futuristic aspect in this is analyzing how AI usage will benefit in Epidural and sub arachnoid blocks.

5. **Pain Management:** The other significant part in oncoanesthesiology would be pain and palliative medicine. AI could make its pivotal part even in this field [9]. Most palliative patients are dependent on chronic opioids usage. The correct dosage of opioid requirement can help these patients in avoiding unnecessary complications. Studies have shown the significance of Heart Rate Variability (HRV) can help in predicting the required opioid dose. AI can help in correct amount of opioid delivery to patient by incorporating HRV module.
6. **Operating Room Logistics:** Tracking Operating room time, checking of machines, OR tables, lights, in which AI help in preventing unnecessary hazardous events.
7. **Tele Anesthesia:** Oncosurgical cases being risky and complicated needs high expertise in handling any complications. During some unpredicted complications help from colleague anesthesiologists virtually can help to avoid panic states. Tele Anesthesia is one such field of AI which is widely popularizing because of its improved quality and safer practices [10].

The potential ways of AI can benefit the clinical practice of oncoanesthesia not through replacement of the clinician but through the augmentation of oncoanesthesiologists workflow, decision making, and other elements of clinical care. AI has already brought tremendous changes in our lives, so maybe in the near future we are yet to witness more of its significance in our fields. Our field cannot be fully automated because of its dexterity-based labor. So successful integration of ai into Oncoanesthesia practice will mainly depend on end users' deep knowledge, attitudes and opinions regarding it.

Conclusion

Hence, its clear that application of Artificial Intelligence (AI) and Machine Learning (ML) will show promising results in oncoanesthesiology. The major contribution of AI in this field would be advanced monitors, simulators and Teleanesthesia. The successful integration of AI mainly depends on end users' attitudes and beliefs. AI will not replace anesthesiologist indeed will help anesthesiologist in achieving better results.

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