

Can the Pioneering Impact of Artificial Intelligence in Anaesthetic Practice Uphold Good Medical Practice?

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Abstract

The potential applications of Artificial Intelligence (AI) in anaesthesia are expansive. However, like any technological advancement, the integration of AI in anaesthetic practice comes with both benefits and potential risks. This article seeks to set out some of the advantages and disadvantages of the use of AI technologies within the field of anaesthesia. Benefits of the application of AI in anaesthesia include an improvement in perioperative risk stratification, personalisation of anaesthetic plans, improvement in efficiency and ultimately reduce healthcare costs. However, reliance on technology may reduce clinical acumen but furthermore there are issues surrounding data quality, privacy as well as legal and ethical concerns, which require further evaluation. Whilst AI within anaesthetic practice holds immense promise, there are substantial challenges which require careful consideration and ongoing evaluation. A collaborative approach will be required from healthcare staff, developers and regulators to promote the safe, responsible, and effective application of AI in anaesthesia practice.

Key words: anaesthetics; AI; data; data protection

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Introduction

The field of anaesthesia has already witnessed transformative advancements with the integration of Artificial Intelligence (AI) technologies. The potential applications of AI in anaesthesia are expansive and range from the use of pharmacological models to risk stratification to complex pain management strategies (Bellini et al, 2022; Singh and Nath, 2022; Singhal et al, 2023; Song et al, 2023). AI promises to enhance precision in anaesthesia, thereby optimising patient care, improve efficiency and ultimately reduce healthcare costs. However, like any technological advancement, the integration of AI in anaesthetic practice comes with both benefits and disadvantages (Singh and Nath, 2022; Singhal et al, 2023).

Advantages

AI can aid in peri-operative risk stratification (Bellini et al, 2022). Predictive models can be leveraged to analyse a variety of patient data to assess the risk factors associated with anaesthesia and surgery. For instance, AI systems can process electronic health records, medical history, laboratory results, and other relevant information to identify patterns and correlations that may indicate potential risks

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for an individual undergoing anaesthesia (Singh and Nath, 2022). These models can then provide an estimate of the patient's risk profile, helping anaesthetists and patients make more informed decisions prior to committing to surgery.

AI could be a useful tool for individualised anaesthetic plans. The administration of anaesthetic drugs demands meticulous precision. AI algorithms can analyse patient data, such as medical history, genetic information, and responses to previous anaesthetics, to calculate optimal drug dosages (Bellini et al, 2022; Hashimoto et al, 2020; Singh and Nath, 2022; Singhal et al, 2023). This can minimise the risk of under or overdosing and result in a more personalised and tailored anaesthesia experience for patients. This is especially pertinent for certain patient populations such as the elderly, where anaesthetic can lead to haemodynamic compromise, or obstetric and cardiac patients, where awareness remains a concern (Song et al, 2023).

AI can certainly improve productivity. AI applications, such as automated documentation and predictive modelling, can enhance the efficiency of anaesthetists (Bellini et al, 2022; Singh and Nath, 2022). By automating routine tasks, such as recording vital signs, clinicians can focus more on patient care and critical decision-making (Bellini et al, 2022; Singh and Nath, 2022). Additionally, AI can play a pivotal role in streamlining the surgical workload in the perioperative period. Pre-operatively, AI can be utilised to read and report medical images, which may assist in procedure planning and risk evaluation. During surgery, robotic systems can assist in complex procedures, augmenting surgical capabilities and consequently diminishing both surgical duration and complications. This, in turn, leads to a reduction in prolonged anaesthesia time, resulting in decreased postoperative patient morbidity (Bellini et al, 2022; Hashimoto et al, 2020).

AI-powered simulations provide a valuable educational tool for training anaesthetists and other healthcare professionals (including anaesthetic trainees and anaesthetic assistants) (Song et al, 2023). Virtual reality scenarios and machine learning algorithms can simulate diverse clinical situations and offer individualised user feedback (Singhal et al, 2023). This allows practitioners to refine their skills, improve decision-making, and enhance patient safety without the need for real-life patient exposure.

AI could improve anaesthetic procedural safety. Mechanical robotic systems have been developed to perform tasks like intubation and regional nerve blocks (Singhal et al, 2023). These include the DaVinci and Kepler intubation systems, each with robotic arms and video systems linked to a workstation, from which the robotic arms can be manipulated by a remote operator (Singh and Nath, 2022; Song et al, 2023). Invasive procedures have the potential to cause significant harm if performed incorrectly or by inexperienced practitioners. Indeed, even the most experienced clinician may encounter difficulties. AI can help to eliminate human error by accurately guiding the user to achieve AI-driven endpoints of clinical interest, for example to target peri-neural infiltration to achieve regional nerve blocks.

Disadvantages

However, there are drawbacks to implementing AI within anaesthesia. There is the potential for clinicians becoming dependant on technology, which can lead to a diminished clinical acumen and reduced emphasis on clinical knowledge and intuition (Singh and Nath, 2022). Additionally, the interpersonal aspect of patient care may be compromised if practitioners solely rely on machine-generated recommendations (Bellini et al, 2022). An algorithm will not consider individual patient concerns or anxiety before recommending a treatment strategy.

AI systems require high-quality, large and accurate datasets to perform effectively. Due to the wide range of sources from which data can be collected it is difficult to guarantee the accuracy and completeness of information used to build algorithms (Bellini et al, 2022; Singhal et al, 2023; Song et al, 2023). Patient safety can be compromised by AI algorithms are built on incomplete datasets.

Furthermore, AI algorithms may be developed based on datasets which may not fully represent the diversity of patient populations (Hashimoto et al, 2020; Singh and Nath, 2022). This can result in a lack of generalisability and produce inaccurate predictions when applied to different demographic groups or clinical settings. Clinicians must be cautious about assuming the universality of AI recommendations and consider potential biases in the underlying data.

The use of AI in anaesthetic practice involves the collection and analysis of sensitive patient data. Ensuring the security and privacy of this information is paramount (Singhal et al, 2023; Song et al, 2023). Concerns regarding data breaches, unauthorised access, and the potential misuse of patient data raise challenges that must be addressed to maintain patient trust and comply with regulatory standards.

Numerous legal and ethical dilemmas must be considered with regards to the use of AI in healthcare. The law remains ambiguous on the matter of liability when mistakes may occur resulting from the use of AI. Patient consent is another ethical issue. They must be made aware of the use of AI in their care and provided with options if they so choose (Bellini et al, 2022).

The implementation costs and learning curve for integrating AI systems into anaesthetic practice will be significant and require a large investment in technology and training. The cost of acquiring and maintaining AI infrastructure, along with the time and resources needed for staff training, can be substantial. Additionally, there may be a learning curve for clinicians to adapt to new technologies, potentially leading to temporary disruptions in workflow and patient care (Singh and Nath, 2022).

Conclusion

The integration of AI in anaesthetic practice holds the potential to revolutionise practice and can offer significant leaps forward in patient care and safety. The benefits ranging from enhanced monitoring to predicting adverse events are diverse and impactful. However, whilst AI within anaesthetic practice holds immense promise there are substantial challenges which require careful consideration and ongoing evaluation. These systems can exacerbate bias and ongoing research is essential to

ensure reliability across diverse patient populations and surgical procedures. The question of data security and the legal and moral issues of AI in healthcare must be addressed. Clinicians must strike a balance between leveraging AI for its advantages and maintaining the essential human aspects of patient care. Ultimately the integration of AI in anaesthesia is inevitable therefore a collaborative approach between developers, clinicians and regulatory bodies is vital to ensure safe, responsible and effective use of AI in anaesthetic practice.

Availability of Data and Materials

All data included in this study are available upon request by contact with the corresponding author.

Author Contributions

TS and YM were responsible for the design of the work, drafting and revision of content. Both authors contributed to important editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

Not applicable.

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Conflict of Interest

The author declares no conflict of interest.

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