Artificial Intelligence Assistance in Regional Nerve Block Deliverance

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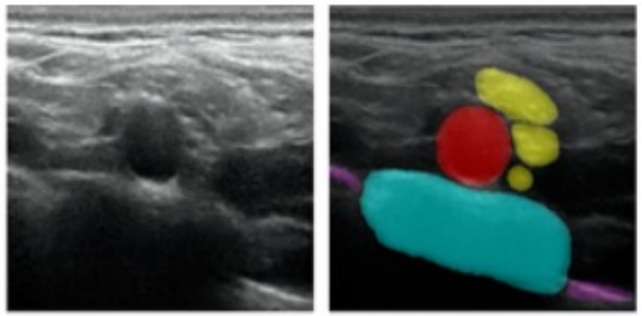
Introduction/Background

Regional anesthesia is a widely used method to aid in pain relief, reduce opioid use, reduce risk of blood clots, and ultimately lead to a faster surgical recovery (Mika et al, 2024). To achieve these benefits, accurate technique needs to be performed. As it stands, manual user block with US is the preferred method. This requires developing technical and cognitive skills and gain in-depth knowledge of anatomy which can take tedious time for new providers. With medical technology advances, the use of AI may soon become a relevant tool in facilitating regional anesthesia. The meta-analysis and literature review conducted aims to explore how AI can assist in labeling anatomical landmarks for US and needle guidance, improve success for less experienced providers, and decrease the time to success.

Objectives

- Understand how artificial intelligence (AI) and robotics are being studied and used for regional anesthesia and the potential they have on the field.
- Explore the history and content thus far related to AI and regional anesthesia.
- Understand how the use of AI and robotics can be useful for learners of regional anesthesia



Methods

The literature review followed a systematic approach of current research and up and coming uses of AI and robotics for regional anesthesia practice. Key terms to research included "AI", "robotics", and "Regional anesthesia". All articles used were from journals of medicine or anesthesia.

Materials and data sources

Inclusion Criteria:

- Articles published between 2013 and 2024 in PubMed, Ovid Medline, Scopus, and Google Scholar
- Experimental Studies
- Studies comparing use of assistive AI on nerve block scanning and local administration to manual guidance
- Having an outcome of scan accuracies, time to learn/perform scan, and/or success of local administration
- Studies focusing on AI assisted surgical landmarking and studies done prior to 2013 were excluded to rule out lack of relevance

Results

- **Hemmerling, et al:** All 16 sciatic blocks performed by the needle guidance of the Magellan robot were successful in 13 post-operative patients.
- **Morse, et al:** There were significant differences in performance times to successful manual block between anesthetists for both superficial (P=0.001) and profound (P=0.0001) nerves in phantoms. (P<0.05 considered significant) There was no statistical difference in time between users for robotic-assisted blocks via the Magellan.
- **Bowness, Varsou, et al:** Efficacy of ScanNav™ AI was rated for less experienced providers as helpful in identifying structures in 1330/1334 cases (99.7%) and for confirming view in 273/275 scans (99.3%).
- **Bowness, Macfarlane, et al:** Of the 126 scans performed and assessed by experts, the correct block view was acquired in 56/62 (90.3%) with ScanNav™ AI assist versus 47/62 (75.1%) without. The correct identification of structures was 188/212 (88.8%) with ScanNav™ AI assist versus 161/208 (77.4%) without (P=0.002)
- **Mika, et al:** All AI solutions presented in this meta-analysis facilitate the performance of regional blocks by less experienced anesthetists and appear as an excellent educational tool which improves the availability regional anesthesia.

Discussion

The findings from the meta-analysis demonstrate AI assistance as an encouraging alternative for facilitating regional anesthesia. ScanNav™ significantly increased the success rate of identifying relevant anatomical conformations (Bowness et al, 2021) and establishing a correct block view (Bowness et al, 2023). Magellan robotics allowed for faster learning of needle guidance over manual positioning and reduced inter-subject performance variability (Morse et al, 2014) while having a perfect success rate in human subject testing (Hemmerling, et al, 2013). Although AI cannot fully replace the human intervention and expertise of an anesthetist, it can offer support and assist with making more conscious choices. The results underscore the prospect of AI assistance in reducing number of block attempts, fewer complications, and a smaller burden for medical personnel.

Limitations

- Very small sample sizes in all literature reviewed
- High Cost (Magellan $50,000), for studies and use
- Currently no AI-based simulation/learning programs
- Limited practical daily use, learners vs experts
- Limited research on application of robotics and AI for regional anesthesia on patients

References

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