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Harnessing Power of Artificial Intelligence in Surgery

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IMPORTANCE Artificial Intelligence (AI) is driving significant changes in surgical planning and navigation. However, the potential role of AI in surgery still requires exploration. Available data shows promising reduction in surgical trauma and improved patient recovery through the use of AI. AI has been a subject of speculation for many decades and research is still focused on the development of this field. Its use in surgery took a longer time than other specialties, however, the data is promising and points towards a revolution in surgical education, training and practice.

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Editorial

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Advancement in the field of artificial intelligence has led to a revolution in healthcare through machine learning (ML) and natural language processing (NLP). Recent research on computational implementation in surgery marks the role of AI as a supplement rather a replacement of surgeons. AI is driving significant changes in surgical planning and navigation. However, the potential role of AI in surgery still requires exploration. Available data shows promising reduction in surgical trauma and improved patient recovery through the use of AI.

Traditionally, pre-operative planning is based on patient's medical records, image-analysis techniques and traditional machine-learning for classification. Pre-operative planning is being boosted by deep learning which has been used for anatomical classification, detection segmentation and image registration. Deep learning algorithms make emergency care possible in abnormalities such as calvaria fracture, intracranial hemorrhage and midline shift via identification from CT scans. Deep learning recurrent neural networks (RNN), used to predict renal failure in real time, and mortality and postoperative bleeding following cardiac surgery, have obtained improved results. It indicates that critical care can be enhanced by giving more attention to high-risk patients.

Foundation of minimally invasive surgery (MIS) is computer-assisted intraoperative guidance. AI learning strategies have been implemented in several areas of MIS. Accurate tracking of tissue deformation is a challenging task in MIS. An online learning framework based on algorithms identifying the appropriate deformed tissue tracking method has been developed for intraoperative guidance and navigation in MIS.

Surgical robots are computer manipulated devices that are designed to assist with surgical instruments' manipulation and positioning. AI assistance through surgical robotics helps in improving skills and performance of surgeons, obtaining superior surgical outcomes and decreasing healthcare expenditure. Asensus Surgical has performance guided laparoscopic AI robot that provides information such as tissue size, thereby supplementing surgeons. While, it requires surgeons' skills for programming by demonstration and for learning by imitating operations conducted by surgeons. Learning from Demonstration (LfD) is robot training in two stages. First stage LfD is splitting complex surgical tasks into subtasks and basic gestures, while, second stage LfD is recognizing model and conducting subtasks in sequential mode. JHU-ISI Gesture and Skill Assessment Working Set analyzed three standard surgical subtasks (suturing, needle passing and knot tying) conducted by surgeons of Johns Hopkins University using kinematics and stereo video. Gestures performed during execution of each subtask were recognized with an accuracy of 80%. Result is promising but indicates room for improvement. Reinforcement learning (RL) is a frequently used ML paradigm. Its' algorithms are formatted based on policies learned from demonstration, hence, RL reduces time required for learning process.

Several different examples of AI-assisted surgeries is available in literature. Surgeons can operate surgical robots through touchless manipulation by using head or hand movements, speech or voice recognition and gaze. Head movements have been used to control robotic laparoscopes, while, FAce MOUse is a human robot interface that monitors in real time facial motions of the surgeon. Maastricht University Medical Center in the Netherlands used an AI-driven robot to suture blood vessels between 0.03 and 0.08

millimeters in a lymphedema patient in 2017. This surgical robot also fixed trembles in the surgeon's hand movements, ensuring that device conducted the procedure accurately. Robotic Hair Restoration enables surgical robots to harvest hair follicles and graft them into precise areas of scalp without the need of donor area removal or manual extraction of each hair follicle. Da Vinci cardio surgery is robotic cardiac surgery used in coronary artery bypass, valve surgery, cardiac tissue ablation, tumor removal and heart-defect repair. Gestonurse is a robotic scrub nurse designed for handling surgical instruments in the operating room.

AI has been a subject of speculation for many decades and research is still focused on the development of this field. Its use in surgery took a longer time than other specialties, however, the data is promising and points towards a revolution in surgical education, training and practice[1-3].

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REFERENCES

1. Hashimoto DA, Rosman G, Rus D, Meireles OR. Artificial Intelligence in Surgery: Promises and Perils. *Ann Surg*. 2018;268(1):70-76. doi:10.1097/SLA.0000000000002693

2. Miller RA, Pople HEJ, Myers JD. Internist-I, an Experimental Computer-Based Diagnostic Consultant for General Internal Medicine. *New England Journal of Medicine*. 1982;307(8):468–476.

3. Monsalve-Torra A, Ruiz-Fernandez D, Marin-Alonso O, et al. Using machine learning methods for predicting inhospital mortality in patients undergoing open repair of abdominal aortic aneurysm. *J Biomed Inform. 2016;62:195–201.*