

Artificial Intelligence and Robotic surgery in Orthopaedics

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Artificial intelligence (AI), first proposed by Prof. John McCarthy in 1956, aims to reproduce human intelligence using computers. Machine learning (ML) is a form of AI that uses computational algorithms that learn and improve with experience.[1]

Artificial intelligence is improving the surgical skills of orthopaedic surgeons by improving their clinical decisions. Technology can improve the surgical skills of the doctors. It can also improve the healthcare system. By this, the computer uses neural networks and learning models to learn to distinguish patterns directly from data and learns on its own to select features to classify the input data. To put it simply, using AI and machine learning algorithms, the surgeon can make good use of a huge amount of data. This allows them to comprehend, predict, act, and learn. (2)

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AI and robotics have significantly impacted orthopedic surgery, revolutionizing procedures and patient outcomes. Robotic systems assist surgeons in performing procedures with enhanced precision and accuracy. They provide real-time feedback, aiding in precise bone cuts and implant placement. Robotic platforms offer personalized treatment plans based on patient-specific anatomy, allowing for tailored procedures and implant fitting. Robotic-assisted techniques enable smaller incisions, reducing trauma to surrounding tissues, minimizing blood loss, and promoting faster recovery times. (3)

The accuracy of robotics leads to improved implant positioning, potentially reducing complications and enhancing the longevity of implants. AI integrated into these systems can analyze pre-operative and intra-operative data, aiding surgeons in decision-making during surgery. AI algorithms can analyze medical images (X-rays, MRIs, CT scans) with high accuracy, assisting in identifying fractures, abnormalities, or degenerative conditions. (4)

AI helps in creating optimized treatment plans by analyzing patient data, medical history, and outcomes from similar cases, assisting surgeons in decision-making. Machine learning models can predict post-operative outcomes, potential complications, and recovery times based on various patient factors. AI-powered rehabilitation systems offer personalized exercise plans and track patient progress, improving post-surgery recovery. (5)

AI facilitates the analysis of vast datasets, aiding in the development of new orthopedic techniques, materials, and implants. Both AI and robotics continue to evolve, offering more sophisticated tools and techniques for orthopedic surgeons. However, their integration into clinical practice often requires ongoing validation, training, and refinement to ensure optimal patient outcomes and safety. (6)

Robotic surgery will also be a common orthopedic technology. Patients have so far shown great interest and enthusiasm for surgery assisted by robots, dazzled by the high-tech sophistication. But they do still prefer

orthopedic surgeons to be around them during the treatment process. (7)

Robotic surgery is making huge advances in medicine. But a large component of the physician/patient relationship, even for surgeons, is communication, which would be lost if Artificial Intelligence and Robotic surgery would be something automatic. (8)

Robotics and AI will be always there in the future and a synergistic relationship between the human mind and them is the way forward for more effective care of patients.

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