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Artificial Intelligence (AI) applications in orthopaedics: An innovative technology to embrace

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Dear Editor,

One of the most significant challenges today in healthcare (including Orthopaedics) is to improve patient outcome quality, and Artificial Intelligence (AI) can provide this capability in several ways. AI is the process of human-like intelligence simulated by using computer-controlled machines. It includes information, reasoning, and self-correction capability. AI is used with intelligent robots and the associated machinery to perform orthopaedics surgery accurately.[1] These systems can detect mistakes in the given environment and provide actionable information regarding heat, light, movement, temperature, sound, and pressure and thus minimizing human errors.

The primary ability of AI is to monitor, manage, and communicate with real-time notifications. This technology allows computer/software-controlled machines to think intelligently similarly as a human being[2] and helps doctors and surgeons to provide efficient treatment and personalized experience.[3] As data of all the patients are different, AI can quickly solve this customization challenge by providing accurate information of an individual patient, which helps to improve the quality of life.

Applications of AI improves the systems capability to evaluate and decide about the treatment in Orthopaedics surgery like traumatic fractures, measurement of bone dimensions, arthroplasty, detection of bone marrow-related diseases, and malignancy depending on the previous iterations of treatment. This technology is available to decide the quality of life, functional demands, and medical status of the patients.[4] Table 1 discusses specific applications as offered by AI in Orthopaedics practice.

AI can analyze the data obtained by various radiographic techniques, in digital forms, like radiographs, Computer tomography (CT), and Magnetic resonance imaging (MRI). It not only helps in an accurate diagnosis but also for the management of Orthopaedics disease and Traumatic injuries. By using this technology, the Orthopaedics surgeon can achieve a final accuracy of 83% during the treatment.[1] AI can also be used to train young medical students and thus, help reduce the risk of the lives of the patient. It seems to be a valuable adjunct to creating an environment to perform successful and reproducible Orthopaedics and trauma surgery, with minimal errors. AI can be used for designing and implementing effector arms that induce meaningful behavioural change and

Table 1
Specific applications offered by Artificial Intelligence in Orthopaedics.

S. No	Applications	Description
1	Accurate analysis of the skeletal radiographs	• AI can demonstrate the minute details of the image in a skeletal radiograph • It can compare the progress of healing of a fracture after the treatment
2	Surgical training	• Surgical training of the medical students is feasible without involving the live patients • With the help of given data of a fractured bone, the trainee doctors can learn about the possibility of better treatment modalities in future
3	Treatment and co-ordination	• It can store the patients' data during diagnosis, therapy, and treatment • It provides excellent coordination between the patient and the surgeon • It alerts about pain, checkup, cause of disease, and other types of medical problems
4	Better performing of robot-assisted Orthopaedics surgery	• The performance of orthopaedics surgeons can be analyzed and checked during the operation and provide suggestions for skill improvement • Has the exceptional capability to combine multiple exam views • Has the potential by better performing of robot-assisted surgery through optimal utilization of surgical instruments
5	Reduce the length of stay in the hospital and follow up visits	• It improves the surgical outcomes and thus reduces the length of stay in the hospital • It helps a surgeon to minimize the errors while performing Orthopaedics and trauma surgery • AI provides all the essential patient-related information to reduce unnecessary visits to the hospital
6	Problem-solving	• AI helps doctors/surgeons to provide better diagnosis, treatment and surgery • It creates intelligence in the medical devices/machines/tools which have the capability of planning, learning, speaking, and problem-solving

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Table 2
Limitations of artificial intelligence.

S.No	Limitations	Description
1	Only learns from the given data	• AI only learns from the given data of the patient • Accuracy of surgery depends upon the captured data
2	Crucial for treatment by machine learning (ML)/AI algorithm used	• One of the significant disadvantages is the percentage of accuracy of prediction by the ML/AI algorithm used, which is very crucial for the treatment and even further • The possible prediction outcome will be the answer whether the role of an AI is an absolute way or it needs more data and training over time
3	Does not understand the emotion	• These machines do not understand emotions, human thought, and reasons to make an accurate decision • This technology only does what it has been programmed to do • It has no other knowledge like a human being to reflect the accurate result
4	Requires proper supervision	• It requires proper supervision and data capturing during treatment; otherwise, doctors and surgeons do not achieve reliable results • Only reliable data provide sufficient results
5	Not provide creative thinking	• It cannot fulfil the creative thinking requirement in orthopaedics like a human being, because a human being can feel, think, and make a valuable decision as to the machine cant • New decisions without any data are not possible by this technology

thus making a meaningful contribution.[5]

AI having machine/information systems providing superior intelligence to predict, perform, analyze, evaluate, and validate the predefined environment. This technology can predict and control infection after surgery by providing accurate information.[6] Orthopaedics surgeon can capture data through this innovative technology to make surgery efficient and safer for their patients. It makes surgical procedure intelligent with better outcomes.[7]

Presently, there are some limitations associated with the AI (Table 2) and must be taken into consideration by the user of this technology.

AI is capable of creating a digital information system for better treatment of patients such as detection of bone loss, treatment planning, imaging, and diagnosis. AI takes over different challenges to improve doctors, surgeon, and patient communication, efficiency and reduce the risks in complicated surgical cases. By providing the right way of information/communication, it should increase efficiency and patient satisfaction. It is also helpful for teaching and learning process of doctors. The future of AI is bright as the orthopaedics surgeon, and other doctors can take advantages of this revolution to increase overall performance in this field.[8]

AI is an innovative way of using available information to perform complex cases efficiently. During a customized surgical case plan, it is helpful in the right selection of surgical implants. It can provide distinct advantages in the operational, clinical, and surgical management of the patients. It would be a useful technology in improving the outcome of Orthopaedics, Spine, and Trauma Surgery. Thus, AI provides the extensive capability to make significant advances in the field of Orthopaedics surgery and patient care.

Conflicts of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jcot.2019.06.012.

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Abid Haleem
Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi, India
E-mail address: ahaleem@jmi.ac.in.
https://scholar.google.co.in/citations?user=4047148AAAAJ&hl=en

Raju Vaishya
Department of Orthopaedics, Indraprastha Apollo Hospital, Sarita Vihar, Mathura Road, 110076, New Delhi, India
E-mail address: raju.vaishya@gmail.com.
https://scholar.google.co.in/citations?user=2Lu3gQ0AAAAJ&hl=en

Mohd Javaid*
Department of Mechanical Engineering, Jamia Millia Islamia, New Delhi, India

Ibrahim Haleem Khan
College of Engineering, Northeastern University, USA
E-mail address: haleemkhan.i@northeastern.edu.

* Corresponding author.
E-mail address: mjavaid@jmi.ac.in (M. Javaid).
https://scholar.google.co.in/citations?user=rfyiwvsAAAAJ&hl=en (M. Javaid)

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