Use of Artificial Intelligence in Surgical Practices

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In recent days news about ChatGPT, which is an artificial intelligence chatbot, became talk of the town. This software is developed by OpenAI and was launched in 2022. The world was taken by storm when news became available to masses through electronic media. This generated debate about capabilities of artificial intelligence and its use in the field of healthcare. Some felt threatened while others considered it an opportunity for improving the management of the patients with better outcome. However, many of the healthcare providers probably are unaware of the fact that artificial intelligence is already in use in various forms in the clinical practices.[1] The field of surgery is not immune to it.

Three terms are often used interchangeably, the artificial Intelligence, machine learning and deep learning, in this context. However, it is important to understand the differences between them. Artificial intelligence (AI) is an overarching term that encompasses all the other. It means in simple language, a machine having an ability to imitate human intelligence or behavior. Machine learning (ML) on the other hand is a subset of artificial intelligence. Machine learning helps in building artificial intelligence based applications. Deep learning (DL) is an advanced step in this context. As a subset of machine learning, deep learning leads to the development of models based upon data set and complex algorithms that are fed to it.[2] This is shown in graphical form in figure I.

Artificial intelligence is used in different ways in the field of health sciences. This has a potential to facilitate
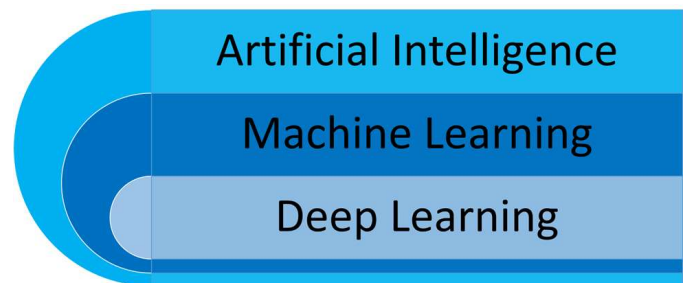

Fig - I: Artificial Intelligence, Machine Learning and Deep Learning Relationship

interpretation of radiological images and pathology slides. This may help in identification of diseases at an early stage. Thus information about the treatment of cancers, genetic disorders and many others conditions can be gathered easily. Another example is that of images obtained at endoscopy. These can be interpreted quickly with this technology and diagnosis can be made with high degree of accuracy. In order to achieve this algorithms have to be developed. This is a demanding task. However, a lot of work is being done in this context. In literature one can find number of studies on the application of artificial intelligence in different surgical disciplines including anesthesiology. Emphasis is mostly on the diagnosis, risk prediction, clinical decision making and others.[3,4]

Artificial intelligence has also contributed to the field of teaching and training at undergraduate and postgraduate level. Incorporation of high fidelity AI based simulation for training purposes is now available in many advanced surgical centers. In the field of minimal invasive surgery it has drastically improved the skills of the residents in training and those who are already practicing. There is a gradual shift from laparoscopic approach towards use of robots in different surgical disciplines.[5]

Use of technology to develop surgical equipment and incorporation of artificial intelligence into their functioning is an interesting area of research as well. This is a common field for biomechanical engineers,

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IT experts and surgeons. It has generated commercial interest as well. Many companies are working on these projects. Advances in the field of development of surgical robots, as an example, has revolutionized the current approach to different surgical conditions. The robotic component not only facilitates the operation but can guide surgeons during the process in identification of pathologies, their extent and best possible approach to deal with them. Robotic surgery thus improves precision in comparison with laparoscopy, ensuring effectiveness and better postoperative outcome. The process requires huge amount of data in the form of videos of surgical procedures. For each type of the surgery volumes and volumes of such videos with clear description of the procedure and precise markings are required. Collaboration therefore is mandatory between experts in the field of artificial intelligence and surgical specialists.[6]

In future it will be possible to develop artificial intelligence based autonomous movements for robotic surgery.[7] AI surgery is expected to become a separate discipline in future to bring innovations in the field. Autonomous actions in the field of robotics require complex interaction between machine learning, deep learning, computer vision and natural language processing, a branch of AI, that facilitate robots and computers to understand, analyze or interpret the voice and text, in order to implement commands or generate response.[8] In short, it is a time for the fraternity of surgical and allied fields to prepare themselves for the change and incorporate artificial intelligence based protocols in their practices.

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