Mesopotamian Journal of Artificial Intelligence in Healthcare
Vol.2022, **pp**. 40–44
DOI: https://doi.org/10.58496/MJAIH/2023/008 ; ISSN: 3005-365X
https://mesopotamian.press/journals/index.php/MJAIH

Research Article

Exploring New Horizons: Surgical Robots Supported by Artificial Intelligence

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ARTICLE INFO

Article History
Received 11 Mar 2023
Accepted 21 Apr 2023
Published 11 Aug 2023

Keywords
Artificial Intelligence
Surgical Robots
Machine Learning
Algorithms
Medical

ABSTRACT

Artificial intelligence-assisted surgical robots combine the agility and accuracy of robotic systems with the cutting-edge capabilities of AI technology. These advanced surgical robots are made to help surgeons carry out difficult surgical procedures more precisely and effectively. Surgical robots with AI algorithms built in can analyse enormous volumes of patient data, make choices in real-time, and adjust to changing circumstances. The surgical process and patient safety could both be considerably improved by this technology. Several important advantages of surgical robots powered by AI include Enhanced Accuracy Surgical robots can make extremely precise motions with little error because of the capabilities of robotics and AI, leading to more accurate surgical procedures. During an operation, real-time decision-making AI algorithms can evaluate data from a variety of sources, including patient vitals, medical imaging, and surgical history, to give surgeons on-the-spot recommendations and insights. Artificial intelligence-driven surgical robots can automate tedious and repetitive activities, freeing surgeons to concentrate on more important choices and increasing operating room productivity. By analysing patient data and delivering individualized insights, AI can help surgeons with preoperative planning, resulting in better surgical approaches and outcomes. AI technology's sophisticated skills can assist in identifying potential dangers and difficulties during surgery, allowing surgeons to proactively address them and reduce unfavourable events.

1. INTRODUCTION

Healthcare is one industry that has significantly advanced as a result of the development of artificial intelligence. AI has been particularly important in the detection and treatment of illnesses, including those involving malignant tumours. The use of AI in surgical robots for conditions with malignant tumours will be the main topic of this introduction. Surgical robots that are AI-powered combine robotic technology's precision and accuracy with the reasoning capacity and decision-making powers of AI systems [1-3]. These robots may enhance surgical techniques, reduce risks, and enhance patient outcomes. By using AI, surgeons may carry out intricate procedures with greater dexterity and precision, causing less harm to the surrounding healthy tissue. Real-time analysis of medical data, such as imaging scans and patient records, is made possible by the integration of AI algorithms into surgical robots [4]. As a result, the excision of the tumour is certain to be as effective as possible while reducing the danger of consequences. Additionally, AI systems can examine enormous datasets of patient data to find trends and forecast the likelihood of tumour recurrence or the effectiveness of particular treatments [5]. Artificial intelligence-powered surgical robots can help with post-operative care in addition to supporting surgeons during treatments. These machines may keep an eye on patients, monitor their recuperation, and give medical experts useful information. AI algorithms can discover possible problems and early indications of difficulties by continuously analysing patient data, allowing for prompt action [6]. It is impossible to overestimate the importance of AI in disorders including malignant tumours. AI enables medical personnel to make more precise and individualised treatment decisions by gathering, analysing, and interpreting enormous amounts of medical data [7]. This promotes the efficiency and efficacy of healthcare systems while also improving patient outcomes.

2. DA VINCI ROBOTIC

The robotic-assisted surgical platform known as Robotic da Vinci sometimes referred to as the da Vinci Surgical System was created and produced by Intuitive Surgical (See Figure 1) [8]. It's made to help surgeons do minimally invasive treatments by

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giving them better control, precision, and visualization. A high-definition 3D camera that offers a magnified image of the surgery site and robotic arms fitted with surgical equipment make up the da Vinci system [9]. The da Vinci system's capacity to circumvent the drawbacks of conventional laparoscopic surgery is one of its main benefits. Greater flexibility and precision are possible thanks to the robotic arms' ability to mirror the movements of the surgeon's hands. As a result, there is a lower chance of problems and better patient outcomes when complex procedures are carried out by surgeons with improved dexterity. Numerous surgical disciplines, including urology, gynecology, thoracic surgery, and general surgery, have made extensive use of the da Vinci Surgical System [10]. When compared to conventional open surgery or pure laparoscopy, it has shown improved outcomes during prostatectomies, including less blood loss, shorter hospital stays, and quicker recovery times. The da Vinci system also has several advantages for both surgeons and patients. The ability to control the robotic arms while seated at a console offers ergonomic benefits to surgeons, reducing their discomfort and tiredness during protracted procedures. Smaller incisions frequently benefit patients, as they cause less discomfort, fewer scars, and a quicker return to regular activities. Despite the da Vinci Surgical System's widespread use and encouraging outcomes, it is crucial to remember that it is an aid for surgeons and does not take the place of their knowledge and judgment [11]. Surgeons use robotic arms as an extension of their own hands to control and supervise the entire surgery.

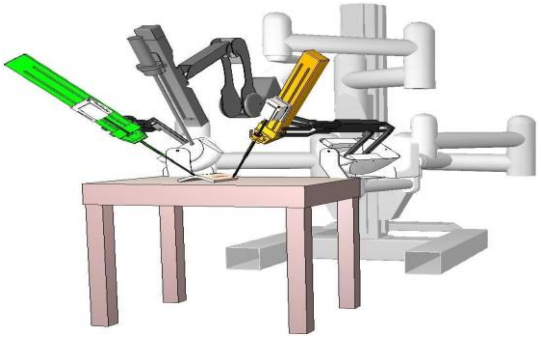

Fig. 1. how work da Vinci robotic [12]

3. ARTAS ROBOTIC

An innovative robotics tool called the ARTAS Robotic Hair Transplant System is intended to automate and enhance hair restoration procedures (See Figure 2) [13]. It carefully extracts and implants hair follicles into balding areas of the scalp using specialized equipment and a robotic arm. The device can automate the follicle harvesting procedures, scan and map the scalp, and produce 3D images of the repaired hairline. Traditional surgery is not necessary with the ARTAS system because it is regarded to be less invasive. It is safe to use on men with dark, straight hair, according to the FDA. With the use of an artificial intelligence algorithm and a high-definition stereoscopic vision system, the system can recognize and choose the ideal hair follicles for transplantation [15].

Fig. 2. ARTAS robotic [14]

When compared to conventional hair restoration techniques, the ARTAS Robotic Hair Transplant has a lower risk of human mistake, does away with linear scarring, and requires less effort [16]. The technology can offer more precision and accuracy, leading to more natural-looking hair growth and happier patient outcomes. Depending on the patient and the particular clinic or provider offering the ARTAS Robotic Hair Transplant surgery, prices and potential side effects may vary. Anyone considering this course of treatment should speak with a licensed doctor and do some research on accredited clinics.

4. VICARIOUS SURGICAL ROBOTIC

A company called Vicarious Surgical specializes in surgical robotics (see Figure 3), with a particular emphasis on single-port abdominal access and visualization. Their robotic technology seeks to advance minimally invasive surgery by giving physicians cutting-edge equipment for better accuracy and results. A high-definition camera with 360-degree views and a wearable virtual reality interface are just two of the cutting-edge technologies that the Vicarious Surgical Robotic System makes use of. This gives surgeons more control and visibility during abdominal surgeries. The business was started in 2014 by Dr. Barry Greene, Sammy Khalifa, and Adam Sachs. Since that time, they have been committed to creating a game-changing technology that will increase access to robotic minimally invasive surgery while lowering patient expenses. The goal of Vicarious Surgical is to improve the safety and effectiveness of operations [17]. Vicarious Surgical's robotic system has been hailed for its innovation. It was even included in Time's list of the 200 greatest inventions of 2022. This acknowledgment emphasizes the innovative potential of their surgical robotics technology.

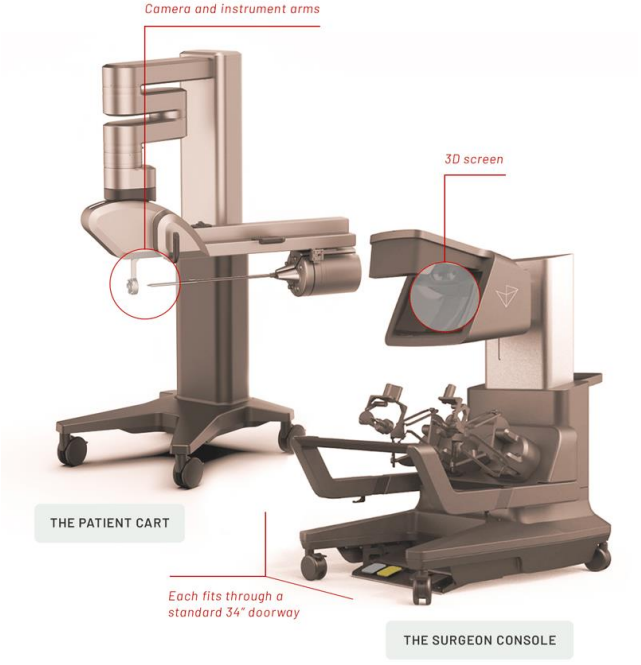

Fig. 3. Surgical Robotics Technology [18]

5. CONCLUSIONS

Artificial intelligence-powered surgical robots are transforming surgical procedures and transforming medicine. These cutting-edge devices improve surgical procedures in a variety of ways by combining the accuracy and dexterity of robotics with the analytical strength of AI algorithms. Surgical robots can carry out intricate tasks with more precision thanks to AI integration, lowering the possibility of human error and enhancing patient safety. Surgeons can make more educated decisions during procedures because AI systems analyse enormous volumes of medical data and real-time feedback. Additionally, this technology enhances planning, simulation, and guidance, leading to more precise and effective procedures. Numerous surgical disciplines, including urology, gynecology, orthopedics, and neurosurgery, stand to benefit from the development of surgical robots powered by AI. They can help surgeons carry out complex operations, outpacing human skills and resulting in better patient outcomes. This technology can also enable remote surgery, allowing specialists to carry out procedures in places where they are not physically present. The ongoing advancement of AI-assisted surgical robots offers bright promises for the future of medicine. These technologies are anticipated to develop further, enhancing surgical outcomes, increasing access to specialized care, and developing new treatment options. The benefit and integration of artificial intelligence and robotics in surgery offer outstanding prospects for advancing medical practice and assisting

physicians and patients everywhere. However, there are still difficulties, challenges, and ethical issues to be resolved. Overall, surgical robots powered by artificial intelligence (AI) are revolutionising the area of medicine and transforming surgical practices in healthcare institutions. These state-of-the-art systems combine the precision and ingenuity of robotics and the analytical power of artificial intelligence algorithms to enhance surgical operations in different ways and methods. By incorporating artificial intelligence, surgical robots can perform complex tasks with enhanced accuracy, reducing the risk of human error and improving patient safety.

AI algorithms can analyse extensive amounts of medical data and provide real-time feedback to surgeons and healthcare workers, enabling them to make more informed decisions during surgical procedures. These algorithms also allow for enhanced planning, simulation and guidance, leading to more accurate, efficient and time-consuming surgeries. In other words, surgical robots are changing surgical techniques and transforming medicine into an environment that relies heavily on artificial intelligence techniques. These state-of-the-art devices improve surgical procedures in several ways by combining the precision and skill of robots with the analytical power of machine learning algorithms. Also, surgical robots can perform complex tasks with more fantastic precision thanks to the integration of artificial intelligence technologies, reducing the possibility of human error and enhancing patient safety. Surgeons can make more educated decisions during procedures because AI systems analyse massive amounts of medical data and feedback in real-time. In addition, this technology enhances planning, simulation and guidance, resulting in more accurate and practical actions. Numerous surgical disciplines, including urology, gynecology, orthopedics, and neurosurgery, stand to benefit from the development of surgical robots powered by AI. They can help surgeons carry out complex operations, outpacing human skills and resulting in better patient outcomes. This technology can also enable remote surgery, allowing specialists to carry out procedures in places where they are not physically present. The ongoing advancement of AI-assisted surgical robots offers bright promises for the future of medicine. These technologies are anticipated to develop further, enhancing surgical outcomes, increasing access to specialized care, and developing new treatment options. The use of AI and robotics in surgery gives great prospects to progress medical practice and assist patients everywhere, even though there are still difficulties and ethical issues to be resolved.

Funding

The authors had no institutional or sponsor backing.

Conflicts Of Interest

The author's disclosure statement confirms the absence of any conflicts of interest.

Acknowledgment

The authors extend appreciation to the institution for their unwavering support and encouragement during the course of this research.

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