

Original Paper

The Comparison between Intelligent Robot Surgery and Traditional Surgery

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Received: August 5, 2023

Accepted: August 25, 2023

Online Published: August 29, 2023

doi:10.22158/rhs.v8n3p71

URL: <http://dx.doi.org/10.22158/rhs.v8n3p71>

Abstract

Briefly discuss the comparison between intelligent robot surgery and traditional surgery in terms of surgical effectiveness and accuracy. This article briefly discusses the advantages of intelligent robots from 9 aspects: controllable range, visualization level, optional modes, reference cases, surgical positioning, probability of error occurrence, patterning and credibility, support technology, and labor costs, and makes a forecast for the future of intelligent robot surgery.

Keywords

intelligence, robotics, surgery, comparison

1. Introduction

Domestic robot competitions are growing vigorously, especially those competitions for college students, which have been held in China for years. Many excellent robot entries from college students were presented in front of people. In the medical field, robots have shown great potential in minimally invasive surgery, orthopedic surgery, patient disease monitoring and care, telemedicine, intelligent rehabilitation and other fields (Meng, Zhang, Tang, et al., 2020). The involvement of robots in surgery started from the developed countries in Europe and the United States. Since The Royal Institute of Technology developed the "Promote" robot for minimally invasive urological surgery in 1980 (Harris, Arambulacoso, Mei, et al., 1997), nowadays the market size of medical robots is increasing year by year. According to the data of relevant institutions, the global market size of medical robots is expected to exceed \$12.7 billion in 2025 (Medical Robots Market by Product & Service, 2021). Da Vinci surgical robots have been used to some surgeries in hospitals with strong comprehensive strength in China, and each hospital takes the number of Da Vinci surgical robots and robotic surgery as the highlight of hospital publicity.

Intelligent robotic surgery means using machine and system model surgery methods and the current AI technology, 3D technology, artificial intelligence, etc., to design surgical methods and surgical scope before the operation, predict and evaluate the possible risks of the operation, and assist the existing navigation mode to avoid the dangerous parts of the operation and the operation that causes serious complications. Common surgery, as most people well known, involve a surgeon operating on a patient with a scalpel, cutting through the skin, removing lesions, stitching, and so on. With the progress of medical technology, general surgery is now more widely used in endoscopy, electrocutter, ultrasonic knife, plasma knife, skin sutures and other new surgical instruments and surgical methods.

This essay mainly discusses the comparison between intelligent robot surgery and traditional surgery in terms of surgical effect and surgical accuracy. Just like the comparison between “clothes washing in a washing machine” and “clothes washing by hand”, when the washing machine first came into the world, many people would thought that washing clothes with hands was much cleaner than just use washing machine. Now this conclusion seemingly may no longer be true, the versatile washing machine even includes drying, which bring more convenience, helps people save time and effort. Moreover, some washers can adjust detergent according to the amount of clothes, choose different laundry modes according to the texture of clothes, these steps would more accurate and effective removal of dirt on clothes, while better protecting the texture of clothes. Some people who don't have much sense of researching and judging the texture for clothes. It's better to use the clothes mode in the multi-function washing machine for targeted washing, which is more favorable to protection and cleaning.

By analogy, with the continuous development of robotic surgery, robots with multiple mode options, can set a suitable surgical methods with AI intelligence based on the current situation, and avoiding surgical danger areas under the guidance of navigation will be able to be born for using and reducing the risk of surgery successfully. In addition, big data can also integrate advanced surgical models in China and abroad to provide knowledge reserves. The advantage of the surgical robotic arm in operating with precision or in a narrow space makes it more advantageous than a human hand-held scalpel or surgical instrument in some specific situations. For example, compared with the traditional drawing-tongue indirect laryngoscope with foreign body forceps, the existing surgical procedure for removing vocal cord polyps with electronic laryngoscope biopsy forceps is more convenient, accurate, and visual, while bringing less pain and psychic trauma to patients.

2. Conclusion

To sum up, this Venter summarizes the comparison between intelligent robotic surgery and traditional manual surgery as follows:

1. The control range is more accurate. For some small and fine operations, the robotic arm can set the control range, which is more precise and accurate than the human hand. Due to the width and size of the human hand, it is impossible to enter some small lacunae surgical operations. But Robotic arms, fingers or forceps can be continuously improved, shrunk, and advanced their functions as needed for

surgery. For example, the application of current robot technology in minimally invasive surgery can well solve the shortcomings of doctors' hand-eye incoordination, easy fatigue, hand shaking in case of affecting the quality of surgery (Fu & Pan, 2019).

2. High degree of visualization. With the rapid development of micro-hole camera technology, the emergence of waterproof cameras and ultra-fine hole cameras can make robotic surgery more visible during the operation, if they can be equipped with devices to absorb smoke and liquid and electric knife devices, carrying out multi-functional and all-round intracardiac surgical operations is not a big problem.

3. A variety of available modes. Surgical resection knives, such as unipolar electric knife, bipolar electric knife, tungsten needle electric knife, plasma knife, ultrasonic knife, grinding drill, etc., can be used to any surgical site and surgical method to select a variety of modes of surgical resection of tissue, suture method is also the same. The operation of the robotic arm can be equipped with different mechanical suture methods according to the needs of intraoperative suture. Irrigation and suction are also advantages of robotic surgery, which is equipped with cameras at different angles and depths, can be operated under visual conditions.

4. So many classic cases can be evaluated and referred. At the present stage of big data integration, and artificial intelligence is surging, medical surgery can refer to a variety of classic cases, such as standardized, systematic and accurate integration through the cloud platform input large database, which can be referred to and selected by surgeons, and robot intelligent algorithm screening, so as to design the optimal surgical method for the station operation, fully learn from the experience and wisdom of predecessors, and achieve the best existing treatment effect.

5. With the advent of navigation equipment with more accurate navigation and positioning and stronger risk avoidance ability, real-time CT imaging or three-dimensional reconstruction of CT images, and existing 3D simulation technology, the positioning of internal human surgery, especially internal bone cavity surgery, are more accurate. The risk around the lesion is clearer, and the risk can be avoided to the greatest extent.

6. Probability of error. The personal mood of a small operation will affect the quality of an operation. In the earlier years, some people calculated that the accumulation of family conflicts of the operation will affect the probability of success of the operation. The change of people's subjective emotions will have more or less impact on the operation. The size of the possible effect will vary from person to person. In addition, there is a limit to human fatigue, and keeping multiple continuous operations for a long time with the stage or the main knife will have a sudden decline in the quality of the operation for the doctors. There's no denying that Robotic surgical precision is generally the same. When the machine is properly maintained and in good working order, the robot can be operated continuously more times than a strong and capable operator.

7. Strong pattern and high credibility. Because of small interference by human factors, some classic diseases and surgical methods can be screened out by robotic surgery, and the most reasonable surgical methods can be unified to remove the lesions and relieve the pain of patients. Compared with

traditional manual surgery, robotic surgery involves less and more artificial uncertainties. On the contrary, this shows that the unified model of robotic surgery is strong, which can remove more unnecessary or human interference factors that will hinder the operation, so that the operation is highly standardized, highly specialized, without adverse human interference, and more reliable. Of course, robotic surgery still has to serve humans, be controlled by humans and manipulators. But when enforced in a uniform fashion, this technique can be beneficial for surgery. The fixed model operation of the robot for classical surgery will make the reliability higher.

8. With the continuous progress of science and technology, emerging technologies, methods and means in different fields and different industries are likely to be applied to the field of robotic surgery. These technologies will make robotic surgery more and more simple, efficient, safe and secure, better for medical services and escort the health of patients.

9. Large-scale mechanized robotic surgery with low labor cost will reduce labor costs, doctors' labor intensity, and the spread of radiation and infectious diseases when it is applied in clinical practice in large quantities (Yang, Hou, Tang, etc., 2023). The development of robots will improve the efficiency and quality of medical services, and contribute to the development of society as a whole.

Robot surgery is on the rise, I believe that in the near future we will see the emergence of more excellent intelligent surgical robots. Moreover, the life and health of the people will be better protected because of the appearance of intelligent robotic surgery. The surgical robot business in China's medical equipment industry is also booming, and our surgical robots with independent intellectual property rights will soon be presented in major hospital operating rooms.

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