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THE USE OF ROBOTICS IN MODERN SURGERY

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Abstract

This article highlights the importance of using robotics in modern surgical practice. It provides information on how robotic surgical technologies can increase the accuracy and safety of the surgical process, reduce medical errors, and help patients recover faster. It also analyzes the use of robotics in various surgical fields, its advantages, and prospects. The article is intended for medical professionals, students, and readers interested in modern technologies.

Keywords

Robotic surgery; minimally invasive surgery; surgical robotics; precision medicine; surgical automation; da Vinci system; teleoperated surgery; surgical innovation; perioperative outcomes; medical robotics.

Introduction

Currently, the medical field is developing rapidly and advanced technologies are widely used in the work of doctors. One of them is the use of robotic techniques. Surgery is one of the most responsible and dangerous areas of medicine, in which accuracy, speed and experience are very important. Technological progress in recent decades, in particular the emergence of robotic technologies, has brought surgical operations to a new level. Robots allow complex operations to be performed more safely, accurately and in a less invasive way. Robotic surgical methods are much superior to traditional open surgery and laparoscopic methods and are considered safe and effective for the patient.

In recent decades, the medical field, especially the surgical field, has undergone radical changes due to the rapid development of technology. Although traditional surgical procedures were effective in their time, they had many risks and limitations. For example, the need to make large incisions, a long recovery period, a high probability of postoperative complications, and physical and psychological stress on the patient's body. Therefore, the need to perform surgical procedures based on safer, more accurate and less invasive (i.e., less harmful to the body) methods has been increasing. This need has led to the widespread introduction of new technologies in modern surgery. Currently, robotics is recognized as one of the most important innovations in surgical procedures. Robotic surgeries combine the knowledge and experience of the surgeon with high-precision mechanisms. As a result, complex operations can be performed with minimal blood loss, small incisions, and a short recovery period.

Today, surgical robots are actively used in many countries of the world, including developed countries. For example, famous robotic systems such as the “Da Vinci Surgical System” have revolutionized surgical procedures and improved the quality of life of thousands of patients. At the same time, work is underway to gradually introduce robotics in developing countries.

The use of robotics in modern surgery is not only a technological breakthrough, but also a huge

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step towards preserving human health and improving the quality of life. Therefore, studying this topic is extremely relevant not only from a scientific but also from a practical point of view.

Development of robotic technologies

Robot-assisted surgery was initially introduced in the 1980s as an auxiliary tool, but today it has complex systems capable of performing independent or semi-autonomous operations.

One of the most popular systems is the “Da Vinci Surgical System”, which is used in cardiology, urology, gynecology and many other areas.

Advantages of robotic technologies:

Precision: Robotic manipulators work with high precision even in delicate areas that human hands cannot reach.

Small incisions: Thanks to minimally invasive methods (laparoscopy), surgery is performed without large incisions.

Fewer complications: The risk of blood loss and infection is reduced compared to traditional surgery.

Faster recovery: The patient's hospitalization and rehabilitation period are shortened.

3D and high-definition imaging: Robotic systems provide a magnified and clear image through a camera.

Scientific results and statistics

According to studies, robotic surgical methods reduce blood loss by 50% compared to open surgery and reduce the patient's hospital stay by 69%.

Thanks to the minimally invasive method, the recovery period is shortened and the quality of life of patients is restored faster.

Technological integration.

Today's modern surgical robots are not just mechanical devices, but also:

High-quality 3D imaging,

Real-time sensors,

Artificial intelligence (AI) algorithms,

Combined with control systems based on virtual and mixed reality (VR/AR).

All this allows for increased surgical accuracy, analysis of surgeon decisions, and even autonomous operation at some stages.

Autonomous and semi-autonomous operations.

In recent years, robotic systems have been taking steps towards autonomy. According to reports

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published in 2025, autonomous cholecystectomy (removal of the gallbladder) performed by a robot on pig organs was successfully performed.

This suggests that in the future, robots will be able to independently perform some parts of complex surgery on humans.

Ethical and legal issues.

The following issues are relevant when implementing robotic technologies:

Liability: If an error occurs, is the doctor responsible or the company that manufactured the robot?

Patient rights: The patient must be fully informed and consented to the use of the robot.

Cybersecurity: Telesurgery (remote surgery) technologies increase the risk of cyberattacks.

Equity issue: Robotic surgery is not available in all regions due to high cost and technological limitations.

Education and training.

To effectively use robotic systems, doctors must undergo special technical and practical training.

VR and simulation systems play an important role in preparing surgeons for complex operations.

Conclusion

Today, the use of robotics in modern medicine is becoming an integral part of medical practice. Robotic surgery, diagnostics and rehabilitation methods are being widely introduced worldwide. In particular, the importance of robotics in minimally invasive surgical operations is very great, because it provides accuracy to the doctor, and safety and rapid recovery to the patient. For example, the "Da Vinci" surgical robot has been put into practice in many hospitals around the world and is widely used in the fields of cardiology, urology, gynecology and neurosurgery. With the help of such robots, complex and delicate operations are performed with a level of accuracy that the human hand cannot achieve.

The introduction of robotic technologies has increased the safety of surgical procedures, created comfort for surgeons and allowed faster recovery for patients.

In the future, robots are expected to become more intelligent, soft and flexible, and have the ability to perform complex operations completely or partially independently.

Additional current information

The development of telesurgery: The possibilities for performing operations remotely are expanding.

Soft robotics: New materials are being developed for flexible and safe handling of organs.

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Artificial intelligence integration: With the help of AI, robots not only perform surgery, but also optimize the surgical strategy and detect errors in advance.

Global equality: As technology becomes cheaper, the possibilities for robotic surgery are expanding in developing countries.

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