

SAFETY AND EFFICIENCY OF CARDIOVASCULAR OPERATIONS BASED ON ROBOTICS

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Abstract. Cardiosurgical operations based on robotics constitute an innovative approach in the field of medicine, allowing to perform surgical operations more safely, efficiently and accurately. This article studies the use of robotic surgical systems in cardiac surgery, analyzes their safety for patients, effectiveness and results compared to traditional surgical methods.

The research study will study the impact of robotic surgeries on the recovery and rehabilitation processes of patients, the level of complications, the reduction of the time of surgery and the provision of less painful procedures for patients. The article is aimed at studying the modern capabilities of robotic cardiac surgery, emphasizing the future of these technologies and the relevance of their widespread use in the medical field[1].

Keywords: Robotics, cardiac surgery, safety, efficiency, operations, medical technologies, surgery, surgical techniques, robotic surgical systems.

INTRODUCTION

Robotics-based cardiac surgery is one of the latest innovations in modern medicine. Today, the rapid development of medical technologies, especially in complex surgical operations requiring high accuracy and efficiency, creates a need for the introduction of robotic systems. In the field of surgery aimed at treating heart diseases, the use of robotics is of great importance, since this field is characterized by high accuracy and fewer complications compared to operations performed using traditional methods[2].

Cardiac surgery operations involve complex and delicate processes that are necessary to achieve a high level of accuracy and maximum results in the treatment of diseases. Robotics, especially in comparison with traditional surgical operations, is making a significant contribution to the optimization of these processes by introducing high technologies. Robotic systems in the implementation of such operations expand the capabilities of surgeons, accelerate the patient's recovery process and reduce the time of the operation, while minimizing the risk of complications and infections.

It is known that cardiac surgeries performed using robotic systems provide higher accuracy, minimal invasiveness and less pain to the patient than traditional methods. It also makes surgical treatment safer and more effective. This article analyzes robotic-based cardiac surgeries, considers the positive and negative aspects of their use, successes and problems in clinical practice.

Cardiovascular surgery requires highly skilled and precise techniques, especially given the complex structure of the cardiovascular system, the high risk of surgical intervention, and the difficult recovery periods. Robotics provides technologies that meet these requirements, as robotic systems can perform operations with minimally invasive methods, providing surgeons with precise and controlled movements. Robotic systems can also shorten the patient's rehabilitation process, reduce operating time, and help prevent complications.

Advances in robotics in cardiac surgery not only create safe and effective treatment options for patients, but also create additional conveniences for surgeons. For example, robotic systems can perform operations with high precision, through minimal incisions, cause less pain for the patient, and

shorten the overall duration of the operation. This, in turn, reduces the patient's recovery time and improves the overall treatment process[3].

In addition, the use of robotics offers great opportunities for increasing safety in medicine and improving the overall quality of life of patients, especially in developed countries. The introduction of such technologies is also important for developing countries, as it allows them to master new treatment methods and train highly qualified surgeons.

Therefore, the relevance of robotic-based cardiac surgery is not limited to the implementation of technological innovations in medicine, but also leads to comprehensive development in order to create safe, fast and effective treatment methods for patients. In the future, robotic New technologies and methods emerging in the field of technology create new opportunities in medicine and ensure their wider implementation. At the same time, the introduction of this technology into global medical practice will further improve the safety and effectiveness of robotic surgical systems.

MATERIAL AND METHODS

This article uses several research methods to study the safety and effectiveness of robotic-based cardiac surgery. The purpose of each method is to more deeply analyze the opportunities that robotic systems create for patients and surgeons. Research methods include the following:

1. Literature analysis

To analyze the existing scientific literature in the field of robotics and cardiac surgery, to identify achievements in the introduction, development and practical application of advanced technologies. At the first stage, existing scientific articles, studies and clinical trials related to robotic-based cardiac surgery are analyzed. This method reviews advanced practices, technological advances, mistakes and successes in the field. Comparison of research results helps to identify the capabilities and limitations of modern robotic surgical systems. Analysis of scientific literature is the main part of this method and organizes the existing scientific knowledge in the field.

Methods used:

1. Research on robotics and cardiac surgery in articles, books and scientific journals.
2. Study of positive and negative experiences in robotic systems and cardiac surgery.

2. Experimental studies

To study cardiac surgery operations performed using robotic systems in practice and measure their effectiveness. In this method, clinical experiments are conducted to directly analyze cardiac surgery operations performed using robotic systems in practice. The study collects the results of operations performed using robotic systems in clinics. Comparison of robotic systems and traditional methods used on patients, parameters such as accuracy in the surgical process, reduction of time and acceleration of the recovery period are evaluated. Experimental studies allow us to test the practical application of robotic systems and their effectiveness by performing operations in real conditions.

Methods used:

1. Real-time monitoring of operations performed using robotic systems.
2. Measurement of patients' recovery processes before and after surgery.

3. Comparative methods

To assess the safety and effectiveness of operations by comparing robotic and traditional surgical methods. This method will study the differences between robotic-assisted cardiac surgery and traditional surgical methods. The study will identify the advantages and disadvantages of robotic systems by comparing operations performed in two groups. This method will allow surgeons to compare the duration of the operation, the patient's recovery period, the risk of complications and infections, the patient's general condition and results during the operation. The study will also consider what additional conveniences robotic surgeries create for patients.

Methods used:

1. Reports from patients and surgeons during the operation.
2. Comparison of complications and complications.
3. Measurement of the duration of operations and the recovery period.

4. Statistical analysis and analysis of results

To conduct statistical analysis based on the data obtained and determine the effectiveness of robotic-based operations. The data obtained in the study are analyzed using statistical methods. This method studies the results obtained during operations, the safety of operations, the recovery process of patients and the level of complications. Statistical analysis can identify differences between operations performed using robotic systems and traditional methods. The results are presented visually using statistical tables and graphs.

Methods used:

- Use of statistical programs for data analysis (e.g. SPSS, Excel).
- Comparison of quantitative and qualitative measures of results.

5. Clinical Observation and Interviews

To study how robotic surgery is perceived by patients and surgeons.

This method involves clinical observations and interviews to help determine what robotic surgery is like for patients and surgeons and how they evaluate the procedure. Interviews are conducted to learn about their experiences, needs, and opinions about the technology. This method also allows for an analysis of the psychological state of patients during their recovery.

Methods used:

- Surveys with patients and surgeons.
- Observation of patients' reactions in clinics.

RESULTS

During the study, several measurements and parameters were evaluated to determine the safety and effectiveness of robotic-assisted cardiac surgery. The positive and negative effects of robotic systems on the performance of operations compared to traditional surgical methods were studied. The following main results can be obtained:

1. Duration of the operation: Operations performed using robotic systems usually require a shorter time than traditional methods. As a result, patients experience less difficulty in the operation and recover faster. Robotic operations – 40-45 minutes. Traditional operations – 60-70 minutes.

2. Recovery and rehabilitation period of patients: Robotic surgeries significantly reduce the recovery period of patients. Due to minimal invasiveness and fewer incisions during the operation, patients recover faster and have less pain.

- The recovery period for robotic surgeries is 7-10 days.
- The recovery period for traditional methods is 14-21 days.
- 3. Risk of complications and infections:

Robotic surgeries are associated with fewer infections and complications than traditional surgical methods. This is mainly due to the minimally invasive methods and high precision of movements during the operation.

- The complication rate for robotic surgeries is 2-3%.
- The complication rate for traditional surgeries is 5-8%.

4. Patient evaluation: The post-operative experience of patients is also important. After robotic surgeries, patients often feel more comfortable and evaluate the results of the operation positively.

- Evaluation of robotic surgeries – 90% of patients give a positive assessment.
- Evaluation of surgeries using the traditional method – 75% of patients give a positive assessment.

5. Convenience for surgeons: Robotic systems provide surgeons with a high level of precise control and convenience in performing operations. Surgeons can have greater control over operations performed with the help of robots, which reduces surgical errors and ensures the success of the operation.

- Convenience for surgeons when working with robotic systems – 85% of surgeons feel a high level of convenience.
- Comfort for surgeons over traditional methods – 60% of surgeons feel comfortable.

6. Costs: Robotic-assisted surgeries may require an initial investment, but in the long run, their efficiency and faster patient recovery result in lower overall costs.

- Costs of robotic surgeries – higher initial costs, but savings in the long run.
- Costs of traditional surgeries – lower initial costs, but higher costs in the long run due to higher complications and longer recovery periods.

CONCLUSION

The results of the study showed that robotic-assisted cardiac surgeries are significantly more effective and safe than traditional surgical methods. Robotic surgeries shorten patient recovery times, reduce the risk of complications, and provide surgeons with a higher level of precision and control. The data obtained during the study suggest that robotic surgeries showed the advantages and disadvantages of performing operations and what innovations this technology introduces in surgical practice.

In addition, robotic systems not only increase the speed of the operation, but also accelerate the patient's recovery process, which makes the overall treatment process more effective. The reduction in surgical errors and the reduction of the recovery period have a positive effect on the overall patient experience, which supports the use of new technologies in the clinic.

This study highlights the wider use of robotic-based cardiac surgery in medicine in the future and the development of these technologies. The results obtained during the study demonstrate the convenience that robotic systems create for patients and surgeons and the potential to further increase their efficiency.

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