



Robotic Surgery

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ABSTRACT- *There is a great advancement in the field of surgery, these advancements came due to a tremendous changes in surgical and computer technology. Recently robotic systems have made a way into the operating room as surgical assistants and surgical planners, in order to answer various demands to overcome the surgical limitations and to avoid various problems . The first generation of surgical robots has already being installed in a number of operating rooms in the present world. These robots aren't truly autonomous, but they are providing a mechanical helping hand to surgeons .Surgical robots are controlled by the methods of Remote control and voice activation .Today Robotics is being introduced to medicine because they provide help for unprecedented control and precision of surgical instruments in various invasive procedures. The main objective of the robotic surgery field is to design a robot that can be used to perform closed-chest, beating-heart surgery. Robots in the field of surgery have made dramatic changes in the procedures for the betterment. The most important use of Robotic Surgery is to decrease the pain of the patient. The limitedness of the incisions also causes many other advantages that make less risk to Robotic Surgery worth. There are various rewards to the patient, Robotic Surgery is also very advantageous to the surgeon and hospital.*

I. INTRODUCTION

As computers brought renaissance in the latter half of the 20th century, the field of robotics has potentially altered the way we live in the 21st century. We are already aware how robots have changed the manufacturing of cars and other consumer goods by streamlining and speeding up the manufacturing process. We even have developed robotic lawn mowers and robotic pets. Robots have enabled us to reach places that humans are not yet able to visit, such as other planets and the depths of the ocean. In the future decades, we may have robots that have artificial intelligence. Some, like Honda's ASIMO robot, will resemble the human form. They may eventually become self-aware and conscious, and be able to do mimic the human in every possible way. Talking about robots doing the tasks of humans is synonym for talking about the future. Presently the robotic technology has developed

a lot and so and so much that it is possible for robots to operate over patients making robotic surgery a reality. Doctors around the world are using complexed and complicated robots to perform surgical procedures on patients. While robotic surgery systems are still relatively very not so usual, several hospitals around the world have bought robotic surgical systems. These systems have the potential to improve the safety and effectiveness of surgeries. But the systems also have some negatives along. It's still a relatively new science and it's very costly. Some hospitals may be holding back on adopting the technology. Robotic surgery is the use of robots in performing surgery. Three important advances provided by surgical robots are remote surgery, minimally invasive surgery and unmanned surgery.

II. ROBOTIC SURGEONS

The first generation of surgical robots are already being installed in a number of operating rooms in the present world. These robots aren't truly autonomous that can perform surgical tasks on their own, but they are providing a mechanical helping hand to surgeons. Still these machines require a human surgeon to operate them and also they require input instructions to operate. There are methods like Remote control and voice activation by which these surgical robots are controlled. Robotics is also being introduced to medicine because they help in various ways for unprecedented control and precision of surgical instruments in minimally invasive procedures. These machines have been used to position an endoscope, also to perform gallbladder surgery and correct gastroesophageal reflux and heartburn. The main motive of the robotic surgery field is to design a robot that can be used to perform closed-chest, beating-heart surgery. Today robotic devices could be used in more than 3.5 million medical procedures per year in the United States alone. There are three surgical robots that have been recently developed:

- da Vinci Surgical System
- ZEUS Robotic Surgical System
- AESOP Robotic System

III. CLASSIFICATION

As we know all surgical robots are not equal. There are three different kinds of robotic surgery systems:

- Supervisory-controlled systems
- Telesurgical systems
- Shared-control systems.

There is a main difference between each system that is how human surgeon is involved in performing a surgical procedure. we can see that on one side of the spectrum, robots perform surgical techniques without the direct interference of a surgeon. On the other end, doctors are performing surgeries with the help of a robot, but in both the cases doctor is doing the majority of the work.

A. *Supervisory-Controlled Robotic Surgery Systems* :

Among the above three categories, supervisory-controlled systems are the most automated. But that doesn't mean these robots can perform surgery without any human guidance. In fact, surgeons need to do extensive prep work with surgery patients before they allow the robot to operate. Dr. Scott J. Boley demonstrates a robotic surgery system at the Montefiore Institute for Minimally Invasive Surgery in New York City.

All this is needed because supervisory-controlled systems follow a specific set of instructions when performing a surgery. The human surgeon must input data into the robot, which then initiates a series of controlled motions and then completes the surgery. There's no room for error -- these robots can't make adjustments in real time if something goes wrong.

B. Telesurgical Systems

The basis of the dexterity experienced in open surgery relies on the almost unlimited wrist, elbow and shoulder's degree of freedom. The degree of freedom in laparoscopic surgery is limited because instruments need to be long and are manipulated through fixed ports. The surgeon has to move around these fixed ports. In order to solve these limitations tools have been designed that have an articulation at the tip, which increases the degrees of freedom and provides a great help.

IV. SURGEON BENEFITS

Its advanced three dimensional view provides the surgeon with a true three- dimensional view of the operating field. This direct and natural hand and eye instrument is similar to open surgery with all around vision and ability to 300min and 300mout.

- Improved dexterity: It provides the surgeon with best operative controls.
- Greater surgical precision: It permits the surgeon to control the instrument with great accuracy. It can be simply controlled by the movement of instruments.
- Increased range of motion: Endo wrist instruments are used in this surgical system. It is capable of rotating the instruments more than300degrees through tiny incisions.

V. APPLICATIONS

A. Cardiac Surgery

Robotic surgery helped in performing Endoscopic coronary artery bypass (TECAB) surgery and mitral valve replacement.

B. Gastrointestinal Surgery

Robotic surgery has helped in Gastrointestinal surgeries also.

C. Gynecology

Robotic surgery in gynecology is one of the fastest growing fields of robotic surgery. Robotic surgery can be used to treat fibroids, abnormal periods, endometriosis, ovarian tumors, pelvic prolapse, and female cancers. Gynecologists can perform hysterectomies, myomectomies, and lymph node biopsies by using the robotic technology. The need for large abdominal incisions is virtually removed. It can also be used for tubal re-anastomosis, hysterectomies and ovary resection.

D. Neurosurgery

Surgical robotics has been used in many types of surgical procedures including complement-image-guided surgery and radio surgery.

E. Orthopedics

The ROBODOC system was released in 1992 by the Integrated Surgical Systems, Inc.Surgical robotics has been used in many types of orthopedic surgical procedures including total hip femur preparation, acetabular cup replacement, knee surgery and spine surgery.

F. Pediatrics

Surgical robotics has been used in many types of pediatric surgical procedures including: tracheoesophageal fistula repair, cholecystectomy, nissen fundoplication, morgagni hernia repair, kasaipuertoenterostomy, congenital diaphragmatic hernia repair, and many others.

G. Radiosurgery

The CyberKnife Robotic Radiosurgery System uses image-guidance and computer controlled robotics

to treat tumors throughout the body by delivering multiple beams of high-energy radiation to the tumor from virtually any direction.

H. Urology

The daVinci robot is commonly used to remove the prostate gland for cancer, repair obstructed kidneys, repair bladder abnormalities and remove diseased kidneys. New minimally invasive robotic devices using steerable flexible needles are currently being developed for use in prostate brachytherapy.

VI. CONCLUSION

Although still in its infancy, robotic surgery has already proven itself to be of great value, particularly in areas inaccessible to traditional laparoscopic methods. It remains to be seen, however, if robotic systems will replace conventional laparoscopic instruments in less technically demanding procedures. In any case, robotic technology is set to boost surgery by improving and expanding laparoscopic procedures, advancing surgical technology, and bringing surgery into the digital age. Furthermore, it has the power to expand surgical treatment modalities beyond the limits of human ability. Whether or not the benefit of its usage overcomes the cost to implement it remains to be seen and much remains to be worked out. Although feasibility has largely been shown, more prospective randomized trials evaluating efficacy and safety must be undertaken. Further research must evaluate cost effectiveness or a true benefit over conventional therapy for robotic surgery to take full root.

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