Robotics in Medical Science

Mayank Arora[1], Anil Dhankar[2], Dr. Monica Lamba[3]
[1, 2, 3] Dept of MCA
[1, 2, 3] RIET Jaipur

Abstract- *Medical robotics is a field that focuses on developing electromechanical devices for clinical applications. The goal of this field is to enable new medical techniques by providing new capabilities to the physician or by providing assistance during surgical procedures. Medical robotics is a relatively young field, as the first recorded medical application occurred in 1985 for a brain biopsy. It has potential for improving the capabilities of physician while performing surgery. This paper reports the use of robotics in medical science. It begins with an introduction of robotics, robotic surgery, how does robotic surgery works, application of robotics in medical science: telepresence, surgical assistants, rehabilitation robots, medical transportation robots, sanitation and disinfection robots and robotic prescription dispensing system. It also includes robotics organs in human body: prosthetics, orthotics, upper limb devices and lower limb devices. It includes strength and limitation of robotics in medical science.*

I. INTRODUCTION

The word 'robot' was originated from a 1922 play called "Rossum's Universal Robots (R.U.R.)" by Karel Capek. This idea was further proved by introduction of Maria, the first female robot on silver screen in a science fiction movie 'Metropolis' released in 1927. Few years later, in 1959, John McCarthy and Marvin Minsky established the Artificial Intelligence lab at MIT. The first modern robotic hand was created by Heinrich Erst in 1961. The first industrial robot was invented in 1962 and named as 'Unimate'.

What is Robotics?

Robotics is a branch of engineering that involves the conception, design, manufacture and operation of robots. The objective of the robotics field is to create intelligent machines that can assist humans in a variety of ways.

What is Surgery?

A branch of medicine concerned with diseases and conditions requiring to operative or manual procedures

Robotic Surgery

Surgery carried out using mechanical arms controlled by the surgeon and surgical instruments and a camera, especially to avoid the need for large incisions.

Medical Robotics

Medical robots allows surgeon to more efficiently manipulate surgical instrument inside patient's body during surgery. Medical robotic includes a number of devices used for surgery, medical training, therapy and assistance people with disabilities. The field of medicine has occupied by robots, they are not there to replace doctors and nurses but assist them in daily work.

Robotic Surgery vs. Traditional Surgery

	Robotic Surgery	Traditional Surgery
Instrument	1.Camera 2.Davinci surgical console	Traditional instrument
Where surgeon stands	At surgical console	Next to patient
How surgery performed	Surgeon directs robots	Traditional instrument
Incision size	Tiny	Big
Risk of blood loss and infection	Less	More
Recovery time	Shorter	Longer

History of robotic surgery

1. In 1985 a robot, the PUMA 560, was used to place a needle for brain biopsy using CT guidance.
2. In 1988, the PROBOT, developed at Imperial College London.
3. The ROBODOC from Integrated Surgical Systems was introduced in 1992 for hip replacement.

4. The first unnamed robotic surgery took place in may2006 in Italy.

Hi-Tech Robots

Hi-tech robots helps nurses in carry plates, clinical wastes, dirty linen and medical supply between wards and also used for sorting pills and clean operation theaters.

Hi-tech robots help doctors in closely monitoring patient information and alerting the medical staff during an emergency. These robots helps humans to do things they may not have been able to do in past, quicker and with fewer errors.

5 ways hi-tech robots help in medicine and healthcare:

1. Medical device packaging
2. Lab automation
3. Cutting bone
4. Therapeutic massage robots
5. Neurosurgery

Health sector robots

1. DaVinci: The davinci surgical system gives surgeons a set of instructions to use in performing robotic-assisted surgery.
2. Endoscopy-Bot: It extends the eyes of the physician into the patient's body to visualize internal organs and guide surgical operations.
3. Orthoses: robotic Orthoses are used to help paralyzed people walk again.
4. Robotic nurses: nursing robots can help in medical supply retrieval, food and medication supply, patient movement and transfer.
5. Pharmabotics: It is research and development company specializing in designing and manufacturing of innovative training model for medical education

Robotics Application in Medical   Science

1. Telepresence: Physicians use robots to help them examine and treat patients in rural or remote locations, giving them a telepresence in the room.
2. Surgical Assistants: These remote-controlled robots assist surgeons with performing operations.
3. Rehabilitation Robots: These robots can be programmed to adapt to the condition of each patient as they recover from strokes, traumatic brain or spinal cord injuries, etc.
4. Medical Transportation Robots: These robots help in supplies medications and meals to patients and staff and communication between doctors, hospital staff members, and patients.
5. Sanitation and Disinfection Robots: With the increase in antibiotic-resistant bacteria and outbreaks of deadly infections like Ebola, more healthcare facilities are using robots to clean and disinfect surfaces.

**Robotics Organs in Human Body**

1. Prosthetics: If you are missing an arm or leg, an artificial limb can replace it. This device can help you to perform daily activities such as walking, eating, or dressing.

2. Orthotics: Orthoses are designed shoe that support the feet and improve foot posture. People who have chronic foot or leg problems that interfere with the health and functioning of their feet, prescribed orthoses by podiatrist.

3. Upper limb devices: It means functional recovery in patients with both neurological and orthopedic disorder due to traumas. It concerns the rehabilitation of the different anatomical parts that make it up: shoulder, elbow, wrist and hand.
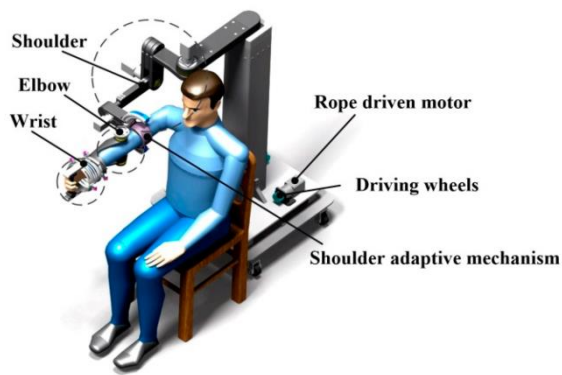
4. Lower limb devices: Robots for stroke rehabilitation at the lower limbs in sitting/lying position have been developed extensively. These robots were developed to provide training at different joints of lower limbs.

Strength of robotics in medical science

1. Shorter stays in the hospital: Because robotic surgery is minimally invasive, there is usually less of a need to keep people in the hospital for very long, which means you can get back on your work and your routine sooner. Spending fewer days in the hospital also leads to cost savings, which is always a good thing in an already costly health system.

2. Reduced pain and discomfort: robotic surgery generally means patients feel less pain and discomfort following their procedure. For example, using undergoing robotic surgery instead of traditional open surgery for a chest procedure can mean you'll need an uncomfortable chest tube for a shorter period of time.

3. Fewer complications: Robotic surgery helps to reduce the amount of human error that occurs during a procedure - making complications less likely. These complications can include damaging tissue unnecessarily or causing too much blood loss.

4. Better clinical outcomes: Robotic surgery can help reduce error during highly complex procedures, compared to traditional surgery. By providing the surgical team with better precision and a detailed view of the surgical area, the chance of damaging tissue is reduced and the surgery more likely to be a success.

5. Minimal scarring: The incision is small for the camera and robotic arms in procedures like appendix or gallbladder removal, which may cause the surgeon to open the entire abdominal cavity. So, it only need small incision when robotic surgery is employed

Disadvantages of robotics in medical science

1. Expense of surgery: The high cost of installing a robotic surgery system can increase the cost of a surgical procedure. Surgical robots are costly to maintain, and their operation requires additional training, which is also expensive.

2. Movement Latency**:** One of the most significant problems with robotic surgery is the issue of latency — the time it takes for the robot to carry out the surgeon's commands. It takes a few moments for the computer to communicate with the robotic arms. While this isn't an issue for routine surgeries, it makes it difficult for surgeons to respond quickly to problems that occur during the operation.

3. Health issues involved with such surgical treatments include patient injury & harm or death during the procedure.

II. FUTURE OF ROBOTICS IN MEDICAL SCIENCE

Intel is working in collaboration with technology providers and researchers to explore the next generation of robotics solutions. For example, Intel Labs China is partnering with the Suzhou Collaborative Innovation Medical Robot Research Institute to establish a medical robotics incubator for startups. Providing technology and research support, Intel is aiding the discovery of new applications for AI and IOT technologies within the field of medical robotics. These contributions support ongoing innovations that increase drive efficiencies, and solve some of the greatest healthcare challenges.

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