

## Editorial



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## Robot and Robotics in Medical World

**R**obot comes from the check word 'Robota' which means "forced work or labour." We use the word robot to mean any man made machine that can perform work or other actions normally performed by human, either automatically or by remote control. Robotics is the science and study of robots. The repetitive works done by humans for months and years are better done by robots; when these types of works are considered to be dangerous for humans. They are used in factories to built things like candy bars and electronics. Robots are now used in medical world, for military tactics, for finding objects under water and to explore other planets. Robotic technology has helped people who have lost arms or legs. Robots are a great tool to help mankind.

### *History :*

In reality evidence suggests that automations were created for everything from toys to parts for religious ceremony in greece and Rome. Leonerdo da Vinchi sketched plans for a humanoid robote in late 1400s. Jackues de Vancason was famous in the 18th Century for his automated human figure that played the flute and for a duck that could flap its wings. Many such are documented in the history; those were created largely for entertainment purpose. Fiction writers found great success in writing in robots in all sorts of situations which meant that the robot was the part of daily conversation and imagination. In 1956 George Devol and Joseph Engleberger formed the worlds' first Robot company. By 1960 s robots were introduced into the General Motors Automobile plant in New Jersey for moving car parts around. Robots continued to develop; now it can be found in homes as toys, vaccum cleaner and as programmable pets etc. Today robots are the part of many aspects of industry, medicine, food pakaging and are used to perform surgery.

### *Parts of a Robot :*

Robots are made of variety of materials including metals and plastics. Most robots are composed of 3 parts:

- (i) **The controller** — These are called the 'brains' which is run by a computer programme.
- (ii) **Mechanical Parts** — Motors, pistons, gripper, wheels and gears that make up robot move, grab, turn and lift. These parts are usually powered by air, water or electricity.
- (iii) **Sensors** — It is to tell the robots about its surroundings. Sensor allows robot to determine size, shape and space between objects, directions and other relations and properties of substances. Many robot can even identify the amount of pressure necessary to apply to grab an item without crushing it.

### *Medical Uses :*

The de Vinci system has been successfully used in following proceduses :-

- (i) Radical prostatectomy, pyleroplasty, cystectomy, nephrectomy, and unilateral ramplantation.
- (ii) Hysterectomy, myomectomy and sacrocolpoplexy.
- (iii) Hiatus hernia repair.
- (iv) Spleen sparing distal pancreactomy, cholecystectomy, heller myotomy, gastric by pass, donor nephrectomy, adrenalectomy, splenectomy and bowel resection.
- (v) Internal mannary artery mobilisation and cardiac tissue ablation.
- (vi) Mitral value repair and endoscopic atrial septal detect closure.
- (vii) Mammary to left anterior descending coronary entery anastomosis for cardiac revascularisation with adjunctive mediastinotomy.

(viii) Transoral resection of tumors of upper aerodigestive tract – (tonsil, tongue base, larynx) and transaxillary thyroidectomy.

(ix) Resection of spindle cell tumors originating in the lung.

(x) Total knee replacement, total hip replacement etc.

Top application of robots in medicine includes telepresence, surgical assistance, rehabilitation, medical transportation, sanitation and disinfection and dispensing prescriptions. Robot specializing in human treatment include surgical robots and rehabilitation robots.

Five recently developed robots currently being implemented in hospitals and treatment centres to improve quality care patients outcomes.

- (1) The de Vinci @ surgical Robot,
- (2) The Xenex – germ zapping Robot,
- (3) The PARO Therapeutic Robot,
- (4) The cyber knife. and
- (5) The TUG.

In 1990 the AESOP system produced by computer motion / action became first system approved by the Food and drug Administration (FDA) for endoscopic surgical procedure. In 2000 the de Vinci surgery system broke new ground for becoming the first robotic surgery system approved by FDA for general laparoscopic surgery.

The first documented use a robots assisted surgical procedure occurred in 1985 when the PUMA 560 robotic surgical arm was used in a delicate nonsurgical biopsy, a non laparoscopic surgery. This leads to a first laparoscopic procedure by robotic system – a cholecystectomy in 1987. In 1992 PROBOT developed in Imperial College, London was used to perform prostatic surgery.

### *Who Created de Vinci Robot ?*

This was created by American company Intuitive Surgical, approved by FDA. It is designed to perform complex surgery using a minimally invasive approach and it is controlled by a surgeon from a console. It is commonly used for prostatectomy, cardiac valve repair and gynecological surgical procedures. The name is given as a token to respect to Leoncndo da Vinci who studied the human anatomy in detail.

Robots contain virtually unlimited knowledge and have microscopical precision. Robotic systems are of two types (1) autonomus and (2) haptic (or surgeon guided). Passive surgery system, which represent a third type of technology has been adopted by orthopaedicians.

Robot surgery offers many benefits to patients compared to open surgery. (1) shorter hospitalisation, (2) Faster recovery and early return to normal activities. (3) Smaller incision hence lesser chance

of infection, (4) Reduced pain and discomfort (5) reduced blood loss and fluid transfusion and (6) Minimum scarring.

Orthopedic surgery began to incorporate robotic technology in 1992, after the introduction ROBODEC for planning and performance of total hip replacement. Now a days the total knee prosthesis and even unicompartment knee arthroplasty is being done with heighest precision.

### *Some Complications to Enumerate :*

- (1) Longer operation and anaesthesia time.
- (2) Device malfunction or failure leading to serious injury and requiring alternate surgical approach,
- (3) Increase in complications may lead to another surgical approach and
- (4) Bleeding.

### *Robotic Surgery in India :*

1st robotic surgery held in India a radical prostatectomy in AIMS, New Delhi in July 2006. Since then more than 2000 robotic radical prostatectomy has been successfully done. 1st ever robotic assisted surgery was successfully performed at Lokmanya Hospital in Pune using blue belt technologies' Navio Robotis system a proven technology in U.S. This follows the first ever unicompartmental knee orthroplasty in India in the same institution in 2017.

Salient features of robotic assisted knee replacement :

1. Precision of surgery.
2. Preserves natural knee structure of the bone, ligament and knee cup etc.
3. Rapid recovery.
4. Minimum blood loss.
5. Minimum pain.

By robotic tool the surgeon can

- (i) Map the diseased cartilage,
- (ii) Prepare a three dimensional visual replica of the knee joint on the computer screen on which the prosthesis virtually placed and aligned.
- (iii) Final execution of surgery by precise placement of the implant as per the three dimensional plan.

This completely eliminates human error to active perfect accuracy and alignment of implant thus enhancing the life of prosthesis. It's no secret that technology is advancing at a rapid pace. This is specially true in health care industry. Operations, treatments and discoveries that were once deemed to be impossible in medical science have come every day realities. Although exiting, these advancements may leave many people wandering what's to come.

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— *Hony Editor*