A Study on Robotic Surgery

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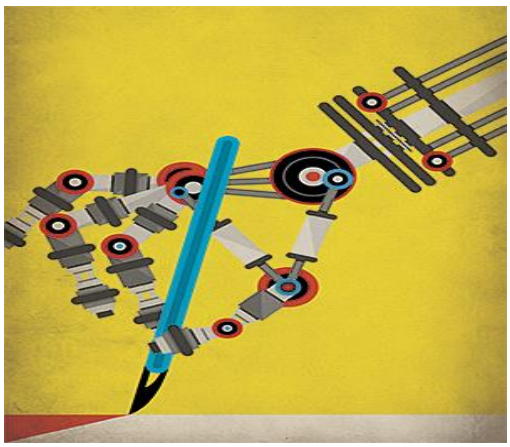
Abstract: Robotic surgery has been promoted since last two decades and has been advanced to a much greater extent. Nowadays many surgical procedures are carried out with the help of robots. Robots in medicine were initially familiarized around 1987 when the first laparoscopic surgery was initiated. Since the time, various procedures have been brought laparoscopically with knowledge, technology and the aids of the surgeons. Various centers are presently working on surgical robots and publishing data. Many studies have proven that robotic surgery is practicable. There is, however, an insufficiency of information about outlays and assistances of robotics. Since the wide range over the globe has started accepting robotic surgery, the time has come to drive to deliver minor, more effective and cheap equipment is driving robotic surgery to reach unheard of heights. Robotic surgery is emerging in most of the hospitals in the world and will soon make a huge impact on surgical line. The main idea behind this paper is to offer a valuation of the advanced robotic medical technology. We sort and associate the invasive robotic structures and talk over their scope in upcoming years.

Keywords: Robotic Surgery, Cost, Effective Machinery, Patents

I. INTRODUCTION

Surgery through robot is a reformed and evolving technology that can be made serviceable for numerous types of surgeries. Argument between robotic companies and surgeons endlessly challenges its operational viability and validity. This research paper will provide all-inclusively knowledge in order to raise awareness and acknowledgement regarding robotic surgery. Furthermore, zones such as legal and ethical concerns, social concerns, and security concerns will be explained [1].



As the reader proceeds, he will receive a treasure of info about the world changing marvel that is, robotic surgery.

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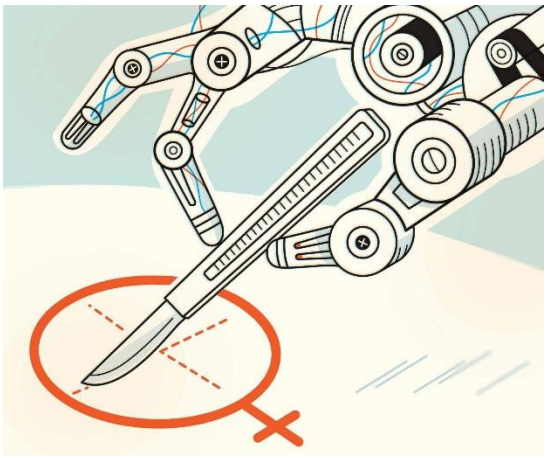
II. ROBOTIC SURGICAL SYSYTEM

Till time, various robots and robotic mechanism fully-automated or semi-automated have been explored and established. Some of these are:

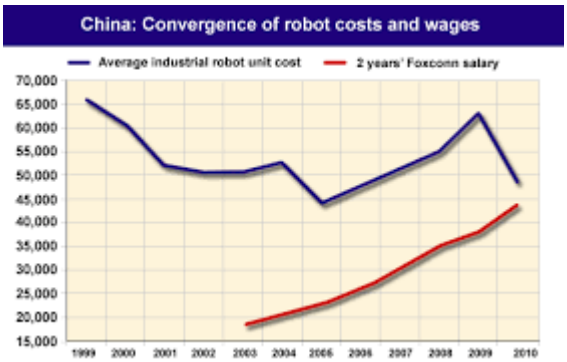
1. Schurr et al at Eberhard Karls University's section for marginally intrusive operation have designed a master-slave schemer system to which they call ARTEMIS.
2. The ZEUS Structure or the ZEUS Robotic Surgical System, released by Computer Motion.
3. Surgical da Vinci robot, principally was designed for soft tissue surgery.
4. "Telepresence Surgery System," which enables the surgeon to achieve surgeries on patients from distance.
5. Dario et al at the MiTech laboratory of Scuola Superiore Sant'Anna in Italy have constructed a model of mini robotic system for computer-enhanced colonoscopy.



There are various factors on which the development of a robot for surgery depends. Some of these factors are [1-3].

II. COST

Robots used for surgery are expensive depending on their modes of operations. But this can be justified if they are used for long run in the society effectively. Robot capital cost not only depends on the hardware and software used by it but also on the other aspects like training, marketing, insurance, patents, technical support etc. Cost of robot also depends on some special types of deals made by different surgeons [1-3].



There are many more aspects to price and it all depends on its usefulness. Cost not only put on towards the principal cost of the tools and costs per process but also the almanac cost of repairs. There are many issues for the troubles and intricacy of the robotic practices, compared to conservative operation.

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This all tends to the importance for extensive preparation in the use of new maneuvers, a zone where the deficiency of exercise has headed to a number of expensive proceedings in current years. Having skilled and trained helpful staff who are familiar with new methods has also been a trouble in many hospitals [1-3].

III. EFFECTIVE MACHINERY

The machines made as the surgical robots nowadays must be effective in performing a special type of task. The introduction of new robots in medical line must be reasonable by a remuneration [1-3].

Achieving this all is very difficult in one society. Even in the surgeries of joint replacement, where handling stiff bone looks simpler to show than lenient tissue operation, amended results are almost negligible to demonstrate mainly over the large span. The body is likely to be very lenient and if results are compared numerous years after the process, it is very important to have neutral data on such traits as precision, configuration and array of gestures instead relying on individual data.

An overall thought of this problematic situation has more lately lead to in recognition of the significant upgrading from mechanical techniques. An additional difficulty with educations over a number of years is that the plan of the machinery is normally halt for the period of the education. It is every so often at an early period of growth of the tools which by the close of the education may have been enhanced significantly, making the outcomes awkward. It must be found out that this is not a fresh miracle and is factual of all forward-thinking tools trials. A further trait revealed is that the hundreds of situations in a conservative study will frequently have been conceded out over a number of years during which the practices and modest riggings will have advanced, mainly after data are collected from a number of various centers [1-3].

IV. PATENTS

One of the problem provoking the starter of new medical machines is that of trial due to sued patent abuse, where many societies have assimilated a threatening assortment of patents. This has resulted in the emergence of many small companies in the developed countries which lack in fund requirements.

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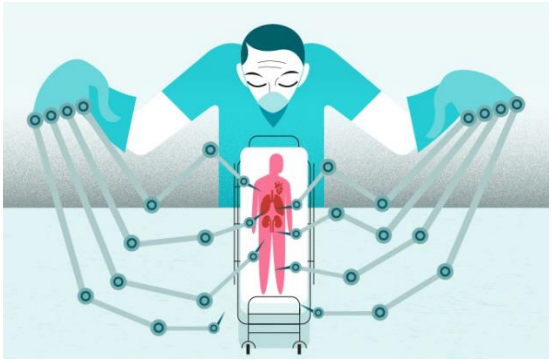
This is all is because of the hope that they may be charged for patent violation. Often such entitlements are not defensible but will need large capitals, especially in the USA, to prove in law court that there is no incident to reply [1-3].

V. INTEGRATION OF ALL THE ELEMENTS INTO TOTAL SYSTEM

As it is the autonomous machine itself which take on the clinical intrusion and organize the clinical apparatuses, it is the entire arrangement which is frequently found of utmost valuable in surgical procedure, with the machine constrained to solitary a negligible part in the wounding procedure. United methods contain patient-specific imaging, which may be preoperative MRI or CT or intraoperative X ray "C" arm or ultrasound. Patient imageries form a strategy of the method and also to mimic the procedure, partly for working out drives and moderately to ensure the planned process has no probable glitches. Once the strategy and imitation is sanctioned, the patient is positioned on the working bench and the mechanical structure is curtailed or "registered" to the patient. This process of cataloging the machine to the patient and to the preoperative strategy is important and is usually one of the main causes of miscalculation [1-3].



Several old-style laparoscopic medical doctors, when specified that there was no need of 3D visualization as they were castoff to attaining distance hints from the shades and mirror image of the surgical act. Similarly, they were used to adjudicating services from tissue distortion and so did not required haptics. A first-hand and younger peer group of surgeons who are used to computer games are greatly more optimistic. Lighter 3D endoscopes and more delicate haptics are facilitating in this renovation [1-3].

Neurosurgery can as well subsidy the accuracy of united robotic operations. The EU mission ACTIVE, for accurate position of rods in epilepsy cure, utilizes 2 Kuka trivial machines to grip tackles while a convention similar machines grips the skull to pay off for gesticulation supervised by means of cameras that trail the shallow of the mind. The in use Canadian robotic system neuroArm uses a specifically advanced neurosurgery MRI companionable tele-surgery couple of arms with "Phantom" haptic pedals. The use of plastic steerable spikes has as well been supported to move on a bent pathway in the brain, thus reducing harm to serious parts when drifting deep inside the brain.

Insofar as concepts, medical automation is a profound, productive soil. It will soon be permitted that machinelike systems are cast-off very minute but the machinery they are creating and the developments in supplementary yields will carry on. By this time, the progress of automation is inciting attention in fresh muscle anastomosis methods, refining laparoscopic devices, and digital assimilation of previously prevailing knowledges.

Solicitations of mechanical surgery are increasing swiftly into numerous diverse surgical castigations. The price of obtaining one of these methods remnants high, still, building it improbable that an organization will secure at most two. This low number of apparatuses and the little amount of

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specialists skilled to use them makes integration of automation in repetitive operations infrequent [1-3].

VI. ADVANTAGES OF ROBOTIC SURGERY

The advantages of surgery through robotic system are several because they cover many of the problems encountered in laparoscopic surgery. Some of the advantages are listed below:-

1. They upsurge handiness.
2. Maintain proper hand-eye synchronization
3. Provide a stable and definite position
4. Improve visualization.

All of these points integrate and generates imageries with improved perseverance that when joined with the improved degrees of freedom and higher handiness, importantly boosts the doctor's proficiency to detect and separate anatomic configurations as well as to build micro anastomoses [1-3].

VII. DISADVANTAGES OF ROBOTIC SURGERY

With some advantages, it also has some disadvantages. Some of these are:

1. This type of surgical procedure is a new technology and its customs and efficiency have not yet been well-known.
2. Higher cost.
3. Size of the system.
4. Shortage of well-suited mechanisms and tools.

Many disadvantages known will be eliminated with phase and developments in technology. Simply phase will tell if the habit of these methods defends their price or not. If the price of these machines rests great, it is unsure that there will be an automaton in every operational area and thus unlikely that it will be cast-off for routine surgical procedures [1-3].

VIII. SCIENTISTS AND THEIR CONTRIBUTION IN ROBOTIC SURGERY

1. In 2000, Da Vinci Surgical System by doctors at Ohio State University.
2. In 2007, the University of Illinois at Chicago medical team, led by Prof. Pier Cristoforo Giulianotti, reported a pancreatectomy and also the Midwest's first fully robotic Whipple surgery.
3. In April 2008, the same team of surgeons performed the world's first fully minimally invasive liver resection for living donor transplantation, removing 60% of the patient's liver.
4. Robot-assisted MIDCAB and Endoscopic coronary artery bypass (TECAB) operations are being performed with the Da Vinci system.
5. In 2002, surgeons at the Cleveland Clinic in Florida reported and published their preliminary experience with minimally invasive "hybrid" procedures. These procedures combined robotic revascularization and coronary stenting and further expanded the role of robots in coronary bypass to patients with disease in multiple vessels.
6. The Hansen Medical Sensei robotic catheter system uses a remotely operated system of pulleys to navigate a steerable sheath for catheter guidance. It allows precise and more forceful positioning of catheters used for 3-D mapping of the heart and vasculature.

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7. IMRIS Inc.'s SYMBIS(TM) Surgical System will be the version of NeuroArm, the world's first MRI-compatible surgical robot, developed for world-wide commercialization. Medtech's Rosa is being used by several institutions, including the Cleveland Clinic in the U.S, and in Canada at Sherbrooke University and the Montreal Neurological Institute and Hospital in Montreal (MNI/H).
8. The first robotic operation inside the eye took place at the John Radcliffe Hospital in Oxford on 9 September 2016. The robot was developed by Preceyes BV and the surgery was performed by Robert MacLaren, Professor of Ophthalmology at the University of Oxford.
9. The ROBODOC system was released in 1992 by Integrated Surgical Systems, Inc. which merged into CUREXO Technology Corporation.[The ROBODOC system was released in 1992 by Integrated Surgical Systems, Inc. which merged into CUREXO Technology Corporation.
10. Blue Belt Technologies received FDA clearance in November 2012 for the Navio Surgical System. The Navio System is a navigated, robotics-assisted surgical system that uses a CT free approach to assist in partial knee replacement surgery.
11. On 17 January 2002, surgeons at Children's Hospital of Michigan in Detroit performed the nation's first advanced computer-assisted robot-enhanced surgical procedure at a children's hospital.
12. 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.
13. In September 2010, the first robotic operations with Hansen Medical's Magellan Robotic System at the femoral vasculature were performed at the University Medical Centre Ljubljana (UMC Ljubljana), Slovenia. The research was led by Borut Geršak, the head of the Department of Cardiovascular Surgery at the Centre.
14. On 12 May 2008, the first image-guided MR-compatible robotic neurosurgical procedure was performed at University of Calgary by Dr. Garnette Sutherland using the NeuroArm.

IX. SCOPE OF ROBOTIC SURGERY

Many robots have been made that can help in surgical procedure, like the da Vinci surgery system. But what if a robot can be automated into carrying out a certain process without any unswerving interference from the doctor [1-3].

The present robotic surgical system cannot run on its own, it should be maneuvered by a specialist. While estimation is allocated on the result, top surgeons, however, do not rule out such a prospect.

Currently, robotic tools can take you to the anomalous areas like tumors, blood clot and abscess so that soft tissue can be cured safely. The next period will be robotic gadgets that can be operated at an angle of 360 degrees, steering the biopsy on its own based on the program fed into the software.

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We have the advantage of all diagnostic imaging—CT scan and MRI—outcomes being merged together into robotic computer so the automated arm can evade injury to other organs.

Maximum medical equipment's are being designed overseas and we have to import them at a high cost. India has wadded behind. If engineering institutes such as IITs and top medical colleges can work collectively, we can overtake them in developing new machineries.

In 1970s, till the CT scan was made accessible, surgeons would discover just on history and clinical analysis to see which part of brain is convoluted. But now we have forward-looking imaging system such as MRI to explore all details of the abnormality [1-3].

X. ALTERNATIVES TO ROBOTIC SURGERY

It is essential to validate the profits from exhausting a robot in contradiction of substitutions which may be greatly economic. Conventionally the chief substitute has been used as a map reading organism, which may include a camera-based tracing scheme or a ideal support with programmed junctions. As this does not utilize engines it will unavoidably constantly be inexpensive than a machine.

Robotic techniques are in overall extra precise than steering but the variance may not result in patient subsidy. A extra current substitute to machines is that of keen health maneuvers and gears which contain some grade of detecting and localized management. A sample of this is a sensor-based cochleostomy drill, that works on union of torque and axial force detecting to control forthcoming revolution of bone in ear surgery, even though the bone width is unfamiliar. Actual minor maneuvers which are too trivial to integrate a motor drive structure can use another exterior power source, such as magnetic structures in which maneuvers can be accurately deployed using exterior magnetic fields to govern the positioning and location for interventional or analytic drives [1-3].

XI. CONCLUSION

Though quiet in its beginning, robotic surgery has by now confirmed itself to be of countless worth, predominantly in zones unreachable to conventional laparoscopic techniques. It rests to be seen, however, if machinelike systems will swap conventional laparoscopic mechanisms in fewer in principle challenging techniques. In any case, robotic machinery is set to transform operation by refining and going up laparoscopic techniques, evolving clinical skill, and carrying operation into the digital phase. Besides, it has the prospective to increase medical treatment modalities outside the restrictions of human capability. Whether the advantage of its procedure overwhelms the price to appliance it relics to be seen and much leftovers to be driven out. Although viability has mainly been

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exposed, extra potential randomized trials calculating efficiency and care must be accepted. Additional investigation must estimate cost efficiency or a right profit over conservative treatment for robotic surgery to take complete essence.

Conflict of interest: The authors declare that they have no conflict of interest.

Ethical statement: The authors declare that they have followed ethical responsibilities.

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