

Day Care Robotic Surgery

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Abstract

Robotic surgery is computer-aided surgery which offers accuracy and precision to a procedure helping eliminate the drawbacks of conventional laparoscopic surgery.

Robotic surgery is in its infancy across the globe, especially in our country. Its role in day care surgery is limited at present. However being a technological extension of conventional laparoscopy, it is just a matter of time that this system will be seen prevailing in the domain of day care surgery.

Introduction

The laparoscopic surgeon must view a distant monitor which provides 2-D vision, leading to a change in the normal hand-eye target axis¹. The 2-D vision has a loss of stereoscopic depth perception which needs the surgeon to compensate for the same. To this add the fact that the camera is being held by an assistant and hence the vision is not under surgeon's control and liable to fatigue, causing an unsteady field of vision². All these factors lead to surgeon and assistant fatigue which are eliminated to a significant extent using the da Vinci surgical robot. The instruments in laparoscopic surgery are rigid and provide only four degrees of motion as compared to the surgical robot which provides seven degrees just like the human wrist does in open surgery. The abdominal wall also adds to this a 'Fulcrum effect' which reverses movements for the surgeon in laparoscopic surgery which is

eliminated in robotic surgery just like we perform open surgery³. Hence in conventional laparoscopy tasks like ligation and suturing are much more complex.⁴

The present day surgical robot

The da Vinci surgical robot is developed and marketed by Intuitive Surgical Inc.(Sunnyvale, CA). The first machine was setup in Europe in 1997 and the first surgical procedure was reported by Himpens et al in March 1997⁵. Since its inception the robot has been gradually upgraded from the first three arm system to current four arms light weight and more versatile version called the S-Type. The system basically has three components: the robotic cart, the surgeon console and the endoscopic stack or column, details of which will be discussed subsequently. The system has technical features which significantly augment the quality and control of the visual field and thus enhance the dexterity of the surgeon. It delivers a high quality three dimensional (3-D) vision(Insite vision[™]) to the surgeon manning the console. This technology allows intuitive telemanipulation with tremor abolition, motion scaling and endo-wristed instruments[™]. This is essentially what gives this technology an edge over the endoscopic technology which has

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been prevailing over the last 2 decades and overcomes some of the pitfalls of conventional laparoscopy which have probably limited the capabilities of the surgeon in the field of minimally invasive surgery.⁶

Ergonomics

The surgeon sits at the console with elbows resting on a padded bar, forehead placed against a padded bar with eyes comfortably viewing into the binocular viewer, the height of which is adjustable. The hand and finger positioning is as mentioned earlier. The intraocular distance can also be adjusted to suit the individuals' needs. The ideal hand positions can be maintained as the surgery progresses by using the clutch pedal to reposition the surgeons' arms and hands.

The Endoscopic stack

This stack has all the features of a standard laparo / endoscopic stack viz: the monitor, a CO₂ insufflator, a dual high intensity light source (Intuitive Surgical Inc.), and a dual CCD camera unit (Insite Vision, Intuitive Surgical Inc.). The features of the camera unit and light source are as already mentioned.

Applications of the da Vinci

More than 600 systems have now been setup across the globe, the majority of them being in the USA. The system was designed for use in minimally invasive surgery, however it can be used for open surgery as well. The robot has been used until now mainly by urologists, general surgeons, cardiothoracic, gynaecologists and paediatric surgeons.

It is best suited for mini-invasive surgeries especially those which are seemingly impossible or very difficult to perform with conventional laparoscopic techniques. Procedures like cholecystectomy, Nissens' fundoplication, adrenalectomy, rectopexy, cardiomyotomy, hernia repair and bariatric

surgery were developed to be performed with standard instruments with the robotic technology.⁶⁻¹²

However it is important to identify the right indications for the use of the robot simply because of the cost factor as of today. Hence it is prudent to classify the indications as follows.

Surgeries unchanged by the robot vis-à-vis laparoscopy, surgeries improved with the robot and surgeries which can be performed only with the da Vinci robotic system.

Day care surgery with the robot!

The shortening of the hospitalization period has led to increasing use of outpatient laparoscopic surgery, and many centres specializing in day-care surgery are using these techniques¹³. The commonly performed minimally invasive procedures, in most parts of the world including India are cholecystectomy, appendectomy, hernia repair, varicocoele excision, myomectomy, etc. All these procedures can be performed using da Vinci robotic system and with much better results with respect to lesser tissue handling and reduction in patient morbidity given the advantages of the system over conventional laparoscopy.

A study has demonstrated the feasibility of several laparoscopic robotic procedures. Operating time and the hospital stay were within acceptable limits for the following procedures where the patients were discharged on the first postoperative day.¹⁴

- Cholecystectomy
- Nissen- Toupet fundoplications
- Tubal reanastomosis
- Inguinal hernia
- Intra rectal procedures
- Varicocoele

The efficacy of conventional laparoscopic

cholecystectomy (CLC) was compared with robot assisted laparoscopic cholecystectomy (RLC). Fewer actions were needed for RLC, although this difference was not significant in a very small group of patients. All the patients were discharged the same day, and all had an uneventful postoperative course. None were readmitted for complications.¹⁵

Future perspectives

With advancement in technology and increase in numbers with proper randomized studies and each procedure being standardized and protocols being fixed for individual procedure, these robotic procedures could also be done as day care in future. With around 600 systems of the da Vinci surgical robotic system across the globe and many centres churning out the numbers and conducting dedicated studies,¹⁶ it is only a matter of time when robotic surgery will be a feasible and affordable option for day case procedures in time to come.

Telepresence surgery offers a technological solutions to expert surgical manpower in remote and underserved areas in our country. It can improve outcomes for infrequently performed and technically demanding operations such as adrenalectomy or Heller's myotomy, for an entire region from a central location such as a university hospital to rural hospitals. Similarly, mobile vehicles carrying the robot would travel in the rural areas, allowing an expert surgeon to remain at the university while efficiently performing the sophisticated operations needed in poor communities¹⁷ just like we have ambulatory surgery mobile hospital vans, moving around in the rural areas of India, performing procedures like cataract, Tubal Ligation, vasectomy, etc.

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TROPICAL DISEASE IN EUROPE

'The occurrence of an outbreak of CHIKV infection in a country with a temperate climate emphasizes that the predicted globalization of human beings and vectors has become a reality'

Chikungunya virus (CHIKV) is transmitted by *Aedes* spp mosquitoes and presents clinically with high fever, headache, rash and crippling joint pain. There is no specific treatment for the disease, but it is rarely fatal. Although acute symptoms last only a matter of days, some patients experience prolonged fatigue and arthritic symptoms for several months. Recently, outbreaks have been reported over a large geographical area, including India and Islands in the Indian Ocean, that are believed to have infected millions of people. Giovanni Rezza and colleagues now report an outbreak in north-east Italy, the first transmission of the virus detected in Europe, which infected 205 people earlier this year. They draw attention to the lack of preparedness of non-tropical countries to tropical diseases, which represent an emerging threat in the wake of globalization. In a Comment, Jean-Paul Chretien and Kenneth Linthicum consider the factors that contribute to outbreaks and spread of disease, and discuss the implications for public-health agencies to prepare for, and respond to, tropical disease infection.

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