

IS ROBOT SAFE AND LEGAL?

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Computer is entered in every walk of life and it looks impossible to work without computers, Similarly computers has entered in the operation theatre. Computer transmits the surgeons hand movements in to patient through robotic arms in key hole surgery.

The term robot was first coined by Karel capek in 1921 in his play Rossums Universal Robots. The robot word was derived from the Czech word "Robota" meaning "Industrial worker". It has gained popularity through science fiction such as Blade Runner & Star Wars. A robot can be defined broadly as a mechanical device that is controlled using a computer system. The first medical specialities to use robots were neurosurgery and orthopaedics. Robotic systems were developed for neuronavigation, stereotactic localization, and robotic assistance. Neuro Mate is commercially available FDA approved device. In Orthopaedics, the Robodoc was developed for placement of prosthetic joints. Robots became popular in cardiac surgery for coronary bypass surgery. In general surgery, it is used in Bariatric surgery, in gynaecology, for reversal of tubal ligation, vault prolapsed, hysterectomy etc. The Food and Drug Administration (FDA) cleared the da Vinci Surgical System in 2000 for adult and pediatric use in urologic, general surgical, gynecologic procedures, general non-cardiovascular thoracoscopic surgical procedures and thoracoscopically assisted cardiotomy procedures

THE DA VINCI SURGICAL SYSTEM

The da Vinci surgical system consists of a surgeon's computer console for surgeon interaction, a surgical cart that houses the video and lighting equipment, and a robotic tower that supports three or four arms. The surgeon's console provides the user a three-dimensional view through a binocular viewport. Interaction is through "masters" in to which surgeon inserts his or her hands. The masters allow free movement that is translated intuitively in to seven degrees of freedom at the robotic instruments tips. A double lens laparoscopic system is combined in to a single three dimensional binocular view. The robotic tower supports three or four robotic with one arm controlling the camera. Endowrist instruments come in a wide range including graspers, scissors, hook, knives, hot scissors and surgical energy devices.

The master slave system has advantages of an ergonomic environment for performing surgery for the surgeon. Surgeon can make natural hand movements rather than counter intuitive movements. It filters hand tremors and scale movements, by digitizing surgeon's hand movements. The robotic arms provide additional degree of freedom inside the patient's body. It provides 3-D view of the surgical field & improves depth perception. With the seven degree of freedom at the instrument tips and 3-D view, suturing becomes much simpler in comparison to laparoscopic surgery.

The port placement is important in robotic surgery to avoid robotic arm collisions. The robotic arms are heavy and there should be a minimum gap of 8 cms between the ports. The camera port and other robotic ports should be in triangulation for easy suturing. There is lack of tactile sensation in robotic surgery which is compensated by magnification and visuals.

The Patient's advantage of robotic surgery is that it is a minimally invasive procedure with less morbidity, shorter hospital stay and early return to work.

The disadvantage of robotic surgery is the initial cost of equipment and cost of reusable robotic instruments. At present, the usage is limited to only 10 per instrument. As a result, cost of the surgery is more compared to open and conventional laparoscopy. As any new procedure, there is a learning curve in the robotic surgery also, however in comparison to laparoscopic surgery; there is a shorter learning curve for the complex urological procedures. The duration of surgery is same as for open surgery and initially may longer during the learning period. The comparative trials are going on to find out the efficacy and effectiveness of robotic surgery in comparison to open and laparoscopic surgery. At present, there are no training facilities in India where as dry and wet animal lab facilities for training in robotic surgery are desirable.

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There are 2,341 da Vinci® System are installed as of 6/30/12. There are 1,707 in United States, 389 Europe, 245 Rest of World. Approximately 360,000 da Vinci® procedures were performed in 2011, up 29% from 2010. About 150 system are installed in Asia and 21 systems in India. The 1st system in India in 2002 in a cardiac set up and in urology at AIIMS in 2006. After that , there was slow progress and during last year, most of the systems were installed.

In Urology at AIIMS, 487 procedures were done till March 2010 and in Medanta medicity hospital, 412 procedures done in urology during the last 2 years. During all these procedures, we have seen minor errors of the robotic system which were correctable during the procedure. We have to convert to open/laparoscopic surgery in 2 cases only.

For all the advanced features the da Vinci system offers, it is surprisingly reliable. In various studies, device failure resulted in case conversion, procedure abortion, and surgeon handicap in 0, 0.5%, and 0.4% of procedures, respectively. As such, a lowered device FR of 0.5% should be used when counseling patients undergoing robotic surgery. To avoid futile general anesthesia, a policy should be enforced to ensure that the da Vinci system is completely set up before the patient enters the operating room.

No major complications are reported in the literature due to robotic system. The over all complication rate of a procedure are less in robotic surgery in comparison to open surgery.

CONCLUSION

Robotic surgery is a significant advance in the realm of urologic surgery esp. for urogenital cancers and for reconstructive procedures. It is associated with ease in dissection, incision and suturing with less steep learning curve in comparison to laparoscopy. It provides all benefits of minimally invasive surgery.

The development of Robotic surgery is slower in Asian countries due to high cost of the robotic system and instruments. Robotic surgery is practiced in few hospitals in Asia. After initial learning curve, outcome is equal. In comparison to open surgery, it has less complications. Robot surgery is safe and legal and is going to stay