

Robotic surgery is ready for prime time in India: For the motion

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Abstract

Robotic surgery with its bundled advantages is still in its burgeoning phase, the best of which is yet to come. The unrivalled suturing ease and motion scaling features, transforming into greater precision, has led to its widespread application in different surgical ramifications. These, coupled with the aforementioned advantages, has led to an increasing number of procedures being performed and that too with improved patient outcomes. It seems that the progressing India is readily accepting this robotic surgical innovation, the use of which is on a continuous rise, with the number of robotic platforms coming up in increasing numbers in many tertiary care Indian centres and a corresponding increase in demand of the same by the patients as well; thereby aptly fulfilling the economics of 'demand and supply'.

Key words: India, robotic, surgery

INTRODUCTION

Since its very inception, surgery, has utilized human hands as the workhorse. Sushruta recognized as the father of cosmetic surgery, centuries earlier quoted 'a surgeon, by his own experience and intelligence, may invent and add new instruments to facilitate the surgical procedures'.^[1] He pointed out the hand as the most important and the best instrument but for which the operation of other instruments cease. Thereafter it has been the hands and the conventional instruments that have stayed on. However, it was the advent of 'laparoscopy' that marked

the modern day minimally invasive surgery. After having being initially utilized in gynaecology, the turn of the present century and the last decade has seen its widespread application in various surgical fields. Specifically pertaining to urology, virtually every surgery has been duplicated as its open counterpart. Nevertheless the rise of laparoscopy had seen many eyebrows of the critics before it has reached its present day status. However, the latter has its own set of concerns in the form of limited degrees of freedom, working with two-dimensional system, transmission of physiologic tremors, the fulcrum effect and so forth. In an attempt to overcome these limitations and at the same time maximizing the benefits of minimally invasive surgery, there came the application of 'robotics in surgery'. The earlier versions such as PUMA-560, PROBOT, ROBODOC have given way to the present day comprehensive master-slave surgical robot the 'da Vinci system'.

SCOPE IN PRESENT DAY SCENARIO

Of the different ramifications in surgery presently, urology and gynaecology are performing the major loads of robot-assisted surgeries, although the proportions being performed in general surgery, cardiovascular, oncology and even transplants off late, are on the rise.

The first Indian urological surgical program was started at AIIMS, New Delhi in 2006.^[2] Ever since then there has been an increase in the surgical robotic systems in India. At present, there are about 19 surgical robotic systems operative in the country. Indian cities with robotic surgical platforms include New Delhi, Gurgaon, Mumbai, Chennai, Nadiad, Bengaluru, Hyderabad. However, with an ever expanding population which currently stands about 1.2 billion, the number presently still stands skimpy.

There is an increasing patient demand for this newer modality of minimally invasive surgery. Nevertheless the pertinent question remains: Is it the need of the hour in present day Indian scenario?

Being a combination of computer technology with surgical handicrafts, it is envisaged as a revolution in itself, marking probably, just a new horizon of surgical innovation.

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There have always been allegations as the technology being market or commercially driven. However, the benefits associated seem to be a package of its kind. The dictum holds true that 'what you see better you do better'. The accompanying $\times 10$ -15 magnification offered by the robotic platform provides an unmatched meticulous anatomy of the surgical field of interest, making chances of inadvertent injury an uncommon event. The anatomic structures are much better appreciated. The three-dimensional vision makes working more ergonomic as compared to that in conventional laparoscopy. In contrast to the latter, there remains no need for the main surgeon to stand and operate, in fact, he sits comfortably on the console site and can perform even marathon surgeries. Likewise, the patient side assistant as well as the nursing assistant can remain comfortably seated for the major part of the procedure, with the prime work of just exchanging the robotic instruments and providing sutures and suctioning intermittently. Needless to say, this translates into much less exertion at the end of the day for both the operating surgeon and the assistants alike. The EndoWrist technology, provides a whole range of movements and 7° of freedom making this an ideal platform for suturing and reconstructive procedures such as prostatectomy, pyeloplasty, partial nephrectomy and other surgeries alike. Motion scaling feature of the robotic system dramatically reduces the unavoidable physiological tremors, again, making suturing and fine dissection tasks as being ideally suited to be performed by this technology and at same time being more precise. The latter two features in particular provide a cutting edge improvement over the laparoscopic as well as the open counterparts. Improved working in deeper body cavities such as pelvis, again is an advantage as compared to the traditional open surgery.

For the existence of any surgical technology or its innovation, it is prudent that the same has surgeon friendly profile and more importantly so, is advantageous to the patient as well. Being minimally invasive in nature, it is associated with smaller incisions, improved cosmesis, less post-operative discomfort, less blood loss owing to the meticulous display of anatomy as mentioned, early recovery and discharge.

With these bundled advantages, the robotic technology is being applied to virtually every surgery being performed by its open surgical and laparoscopic counterparts.

As there are two sides of the coin, there are concerns that need to be addressed.

The critics first and foremost point to the cost, both capital and recurring. Yes, it is tacit that the major hurdle for the robotic technology to become cosmopolitan is the cost. One of the reasons could be a single large manufacturer presently being the

dominant market supplier that is, the Intuitive Surgical of the da Vinci system. Notwithstanding the fact that robotic surgical platforms have a multi-million market, there are other contenders on the fence to join the business^[3] - the University of Washington's Raven II, Titan Medical's Amadeus systems, SOFAR's Telalap ALF-X, and the ARAKNES project to mention a few. If these are out with cheaper alternatives, probably it wouldn't be surprising to see these sophisticated systems outreaching to the common man as well. Some of these could also come up with reusable instruments, further lowering down the finances involved.

The other issue involved is the learning and expertise. There is no doubt that presently very few centres are involved in rendering robotic surgery services to the community. The reason being acquisition of robotic surgical skills involves undergoing either a fellowship program or working under a mentor with necessary skills, over a period of time. The outcome of either of these is a very small fraction of super specialists reaching out to the billion population. However, this can be overcome with time as more surgical platforms become installed including the teaching institutes, so that a larger section of the budding surgeons can serve the community. However, it has been seen that though having a learning curve of its own, the same is not as difficult as is learning laparoscopy. The brighter side is even the surgeons of the open era, who are not facile with the typical laparoscopy, may still learn and perform on a robotic platform, although the ones who are well versed with laparoscopy have an obvious advantage. The most overt advantage is specifically the suturing task which seems much easier as compared to the laparoscopy counterpart. To further shorten the learning curve, future may even see an upcoming of simulators for acquisition of robotic skills.

The number of robotic platforms being established are on the rise so is the number of cases being performed, not only abroad, but in India as well. As with any other technology the outcomes continue to improve with an increase in experience. In a country like ours, there is no dearth of talented surgeons and urologists. This coupled with an ever increasing patient load and upcoming medical insurance schemes, renders our country a fertile soil for such platforms to grow and prosper. In the past 3-4 years there has been a steep increase in the installation of these robotic systems across the country. All the major cities are experiencing an increase in the number of large corporate sector hospitals which are readily establishing robotic surgical platforms. With the multi-specialty utilization and increase in the number of cases performed each day, the cost-effectiveness can be markedly improved.

Specifically in India, the cost comes out to be cheaper as compared to similar robotic surgeries performed in the

western world. In fact, this can be utilized as a means for promoting medical tourism, which in turn could bring the country to a new frontier.

Finally, there have been allegations by the critics that the technology is primarily an industry driven. However, there is enough literature support for the utility and advantages of the newer modality in question.

WHAT THE LITERATURE HAS TO SAY

There is no doubt that the best piece of evidence comes from the meta-analysis, systematic reviews and well-conducted randomized controlled trials, that is, level 1 evidence.

In a meta-analysis of four randomized controlled trials of robotic-assisted versus laparoscopic colorectal surgery to compare the safety and efficacy, Liao *et al.*^[4] concluded lesser blood loss, recovery time and conversion rates with robotic-assisted procedures as compared to laparoscopic ones.

In a systematic review and meta-analysis of robotic radical cystectomy versus open radical cystectomy, the former was found to have lower high-grade complication rates and mortality compared to the open approach.^[5]

Various trials have also tried to address the issue of cost.

Systematic review by Ramsay *et al.*^[6] with reference to robotic prostatectomy suggests that though being more expensive in terms of capital and maintenance costs, these could be brought down by if the capital cost of equipment is minimized and by maintaining a large patient turnover of at least 100-150 procedures per year per robotic system.

A comparative direct cost analysis of paediatric urologic robot-assisted laparoscopic surgery versus open surgery by Rowe *et al.*^[7] shows interesting statistics. The authors found the direct incurred costs of robotic surgery to be significantly lower compared to the open counterpart. However, for this to take effect it is important to have a dedicated and consistent robotic surgery team, meticulous patient and procedure selection as well as high patient turnover.

A systematic review by Gala *et al.*^[8] comparing robotic gynaecologic surgery with laparoscopic and open counterparts, came out with the fact that robotic surgery consistently conferred shorter hospital stay. The learning curve for robotic surgery was found to be lower than for conventional laparoscopy as well as the technique to be advantageous as compared to its open counterpart for management of endometrial cancer.

Renal transplantation, a procedure performed by open means, is now no more an exception to the robotic realms and a feat that has been successfully accomplished recently.^[9] Menon *et al.* have recently shown the safety of the same with regional hypothermia.

CONCLUSION

Robotic surgery with its bundled advantages is still in its burgeoning phase, the best of which is yet to come. The unrivalled suturing ease and motion scaling features, transforming into greater precision, has led to its widespread application in different surgical ramifications. These, coupled with the aforementioned advantages, has led to an increasing number of procedures being performed and that too with improved patient outcomes. It seems that the progressing India is readily accepting this robotic surgical innovation, the use of which is on a continuous rise, with the number of robotic platforms coming up in increasing numbers in many tertiary care Indian centres and a corresponding increase in demand of the same by the patients as well; thereby aptly fulfilling the economics of 'demand and supply'. Last, but not the least, it wouldn't be unfair to say the fiction of yesterday, is translating into a vividly seen reality of today and a horizon of unmatched surgical excellence of tomorrow.

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