Abstract

Introduction
In the ever evolving field of medical sciences 'change' is the rule. We change our concepts, outlook, practice and guidelines based on the recent developments and recommendations. Amongst these, a few developments and technological advancements carry the potential to uplift the concerned specialty to the next level of clinical care and outcome. The introduction of robotic assistance into surgical practice can be considered to be the next milestone. With the increasing popularity of the robot, thanks to its well described benefits to the patient and surgeon in particular, more and more institutions worldwide are spreading out the red carpet to this recent technology. Setting up a protocolised perioperative care catering to multispecialty robotic surgeries is a mammoth task requiring meticulous planning, confidence building, business development strategies and training of operating room staff. Table 1 enumerates the surgeries that can be performed by robotic assistance. In this review we describe the essential building blocks for setting up and smooth functioning of a multispecialty robotic surgery programme with special emphasis on the problem areas. The aim of our article is to apprise the clinicians of the various technicalities and infrastructure requirements before starting the programme.

Conclusion
Aggressive marketing, well defined surgical advantages, lesser morbidity at least in certain procedures have popularised the robotic assistance in surgical field an exciting proposition for the patient and the surgeons. This in turn is the market force which is driving up the sale of robots.

Introduction
Starting a Robotic Surgery Programme
The first step in the successful launch of any new programme is 'Planning'. Starting a robotic programme is a difficult proposition and needs a lot of bold decision making on part of the hospital administration.

The cost of initial acquisition, annual maintenance and inventory management can be a real burden in a turnover set up. The factors that need to be considered are the population catered, their affordability to high end healthcare, competition from nearby robotic surgery centres, the in-house specialties etc. A robotic core committee should be formed comprising of the medical director, marketing head and heads of involved surgical specialties. This is depicted in figure 1.

It is very important to set realistic targets for the robotic programme and formulate ways to achieve the target. The Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) have set guidelines and consensus reports on Robotic surgery requirements for the Institution4. This can be a useful document in the planning and initial execution process.

Worldwide, the number of surgical robots have gone up exponentially. Almost 2585 da Vinci systems have been installed worldwide till date2. In India itself, the number of institutes having a surgical robot have increased to 22 till December 2013 and many more are in the fray. For the institution and the surgical fraternity, it is a matter of pride and prestige to have a surgical robot. It also gives an insight into the institute's progressive vision and quality consciousness and commitment. On the flip side, procuring the surgical robot is in itself a major decision for the Institution. The cost of present day 3rd generation da Vinci robotic system comes to approximately 1.5 – 2.5 million US Dollars3. Along with it comes the concerns of returns on investment and annual maintenance cost which in itself can come to around 10% of the capital acquisition cost. The cost of supplies and instruments accounts for nearly a third of average total cost. In the initial period, there is the added concern of loss of remuneration because of prolonged OR set up and operative time. Interestingly, hospitals are actually looking at this dismal picture from an entirely new angle. Their vision has shifted from cost accounting as the sole modality of financial decision making to newer metrics comprising cost accounting, planning and aggressive business development policies.

A major downward shift in cost is observed when the number of cases increases from 20 to 100 per year. An increase from 100 to 500 cases per year can reduce the cost further by around 18%4.

Probably one of the most important pillar of a successful robotic surgery programme is the presence of a chief robotic surgeon5 in the Institute who actually acts as the Captain of a ship and initially sets the ball rolling. The presence of one principal surgeon

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initially helps in team building and better understanding between the perioperative care providers and setting up the basic institutional protocol. It is very important for the initial few surgeries to be complication free as far as possible. Any sentinel event for any new programme can be damaging. Subsequently more and more surgeons can join and step up the number of surgeries performed. The basic idea behind a successful and economically viable robotic surgery programme is that the robotic system should not be kept idle for a single day and involve as many surgical specialties as possible.

The aim of this article is to apprise the surgical and anaesthesia team of newer set ups about the considerations and requirements before and after procuring the surgical robot.

Development and growth
Searching for more avenues of attracting patients into the robotic programme is a dynamic process. The most important step towards this is maintaining the highest level of clinical quality. Quality care and patient satisfaction can speak volumes about the Institute’s infrastructure, surgical skill and level of preparedness to sustain such a high end programme. Inculcating more and more specialties (existing or new in the Institute) will encourage a fair flow of patients. This may need inducting trained surgeons or providing short term training facilities for in-house clinicians. Counselling the patients while being reviewed as outpatients priming and apprising them of the existence of the robotic technique for their surgery and highlighting its benefits helps in the growth of the programme. The strategic planning should also look beyond the institute and identify clinicians who have an open outlook for newer techniques and try to get referrals from them. They can serve the last minute connectivity between the patients and a good robotic surgery programme. Last but not the least, the role of social media cannot be ignored in spreading awareness in the society. But, one needs to be very neutral and genuine in propagating the robotic technique, because the entire blame may fall on the robotic programme if something goes wrong after aggressive publicity. This has already been perceived and well palpated worldwide.

The increasing number of robotic surgery complications has led the Food and Drug Administration to review their license of da Vinci Robotics6,7 and the creation of a new brand of legal advisors who specialise in court cases and litigations related to robotic surgery complications.

Data collection, self-evaluation and knowledge sharing
A thriving robotic surgery program is much more than only the numerical figure of total procedures performed per year. Quality monitoring, record keeping and data collection is equally important. It helps in analysing progress, growth, highlighting problem areas, lacunae and the information obtained becomes a tool of self-evaluation.

The robotic coordinator is important in updating all the information and he/she periodically organises core committee meetings to discuss the issues. The Institute’s clinical data needs to be presented in national and international events and gatherings.

This is a powerful way of self-evaluation amongst the peers. Development of a training programme and offering fellowships or observerships to young and interested surgeons is an important outlet of knowledge sharing and popularising the programme.

Performance benchmarks
Once started, every hospital should strive towards achieving certain set performance benchmarks without compromising patient safety. This varies with the surgery. For robotic prostatectomies the benchmarks can be 200 intraoperative minutes, <30

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Table 1: Types of surgeries amenable to robotic assistance.

<table>
<thead>
<tr>
<th>As per popularity</th>
<th>Surgeries</th>
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<tbody>
<tr>
<td>Well established robotic surgeries</td>
<td>Pelvic procedures: Radical prostatectomy, hysterectomy, radical cystectomy, Cardiac surgery: coronary revascularisation, cardiac valve replacement, Robot assisted thoracic surgeries (RATS): lobectomy, pneumonectomy, thymectomy, mediastinal mass excision, esophagectomy; Transoral robotic surgery (TORS).</td>
</tr>
<tr>
<td>Occasionally performed robotic surgeries</td>
<td>Renal transplant, donor nephrectomy, donor hepatectomy, systematic nodal dissection.</td>
</tr>
<tr>
<td>Robotic surgeries of near future</td>
<td>Ocular surgery, bariatric surgery</td>
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Figure 1: Inter departmental communication in a robotic surgery programme.
minutes set up time, <30 minutes turn over time and 1.5 day hospital stay. In the case of robotic hysterectomy for malignancy, the performance benchmark is almost similar.

Discussion
Operating Room (OR) Requirements and Considerations
The following paragraphs deal with the infrastructure required and basic technicalities of a robotic programme.

OR requirements and orientation
Based on personal experience in the absence of recommendations, to comfortably house the da Vinci robotic system along with other routine logistics and staff and to still maintain an unobstructed flow inside the OR, approximately 400-500 square feet area is required. Roco et al. have proposed an OR size of 60 m². Moreover, the OR should be square shaped to ensure easy docking of the robot from different sides as per surgical requirement. Most of the ORs of existing hospitals may not fit into this requirement. Table position should be central in the OR as in routine procedures. The orientation of the table needs to be changed depending upon the nature of robotic surgery.

For thoracic surgeries the table may be turned 180° away for easy docking of the robot. Similarly in transoral robotic surgery (TORS), patient may need to lie with his head on the foot end of the table (to accommodate the base of the patient cart under the table). The console can be kept at any of the less frequented corners of the OR, e.g. the opposite wall corner of the OR door.

The patient cart and vision cart are the mobile units of the robot. Connecting cables can create a mess if robotic parts are not positioned in ergonomically correct places. It is vital that no cable is accidentally unplugged by OR personal movement during a procedure for the simple reason of compromising patient safety and increasing the instrument count once restarted. Figure 2 depicts the typical operating room set up.

Figure 2: Schematic diagram of the typical OR ergonomics.

OR personnel
Two anaesthesiologists and one each of surgeon, surgical assistant, scrub nurse, circulating nurse and technologist should be available at any given point of time. The presence of an engineer from the robotic company is highly recommended at least in the initial learning phase.

A close communication among the team members is vital. The technologist and the nurse should be expert in system start up and preparing the robot for the surgery including shifting, cleaning, draping, instrument exchange etc. Sustaining a trained team of OR personnel is a management challenge. Robotic instruments are costly and have limited usability. The OR technologist has important role in optimal patient positioning, docking and undocking of the robot and overall maintenance. Training them to the desired level is a rigorous process and so maintaining the same staff is highly recommended. Maintaining the same trained team will eventually cut down the set up time drastically and can be a major influence on the economic viability of a robotic programme.

Preparing the robot for surgery
The process of preparing the robot should start much ahead of the patient wheel in time. The anaesthesiologist should ensure that before patient induction the robot is switched ‘ON’ and checked to avoid the situation of an anesthetised patient with a non-functioning robot. Once the surgical ports are created, OR table is brought to the final position. The technologist or the surgical assistant then moves the patient cart to the desired position.

No further movement of the cart or the table is permitted. The remote of the table should be switched ‘Off’ to avoid unintentional activation. Undocking the robot after the surgery should be equally meticulous. Cleaning of the robot after the procedure is over

The robotic drape is removed and instruments are dismantled after the procedure. Each robotic instrument has two channels which should be flushed sequentially as per the numbering. Then chemical treatment with enzymes are done and sent to the central sterile supply department for further processing.

Maintenance
Regular maintenance check is mandatory for uninterrupted functioning of the robot. Some dedicated maintenance hours should be scheduled beforehand that do not interfere with the OR functioning.

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Emergency undocking drill
Periodical robot undocking mock drill should be incorporated as a part of training for the OR staff. This ensures a rapid undocking in the event of robotic malfunction and other patient related emergencies. Ideally it should not take more than 30 seconds to undock a robot in the event of an emergency.

Shifting the robot from one OR to the other
Although frequent shifting is not recommended, if necessary the robot can be moved to another OR by a trained staff or by a company engineer.

Uninterrupted power supply
Power shut down is the worst thing that can happen when robotic instruments are inside the patient’s body cavity and dissecting a vascular area. Robotic plugs should be connected to uninterrupted power supply (UPS) points to ensure smooth surgery and patient safety.

Back up surgical plan
Conversion plan to laparoscopic or open technique should always be in place and required informed consent should be discussed and signed beforehand. Instruments necessary to open the patient should always be available inside the OR.

Robotic inventory maintenance and disposal
Robotic endowrist and scissors are meant to be used 10 times only. Beyond that, the robot ceases to sense them. So, use count of the instruments and continuous supply of inventory is essential and discarded instruments should be disposed off as per local waste management protocol.

Management of anaesthesia services
A good knowledge and experience of the anaesthetic management of laparoscopic surgery and considerations in various non-physiological patient positioning are the primary building blocks of the anaesthesia services in robotic surgery.

It requires a lot of planning and foresightedness and highest level of vigilance, coordination and communication between the team members to prevent or early detection of perioperative complications. To bring more objectivity to the practice, protocolisation should be stressed upon. At least two experienced anaesthesiologists are required for complex robotic surgeries.

Conclusion
Aggressive marketing, well defined surgical advantages, lesser morbidity at least in certain procedures have popularised the robotic assistance in surgical field an exciting proposition for the patient and the surgeons. This in turn is the market force which is driving up the sale of robots.

References