The Da Vinci Xi in Robotic Radical Prostatectomy- An Evolution in Learning and Technique

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Abstract

Introduction: The Da Vinci Xi robot has been introduced as the successor to the Si platform. The promise of the Xi is to open the door to new surgical procedures. For robotic assisted radical prostatectomy (RARP)/pelvic surgery the potential is better vision and longer instruments. How has the Xi impacted on operative and pathological parameters as indicators of surgical performance?

Methods: This is a comparison of an initial series of 42 RARPs with the Xi system in 2015 with a series using the Si system immediately before Xi uptake in the same calendar year and an Si series by the same surgeon synchronously as the Xi series using operative time, blood loss and positive margins as surrogates of surgical performance.

Results: Subjectively and objectively there is a learning curve to Xi uptake in longer operative times but no impact on T2 positive margins which are the most reflective single measure of RARP outcomes.

Subjectively the vision of the Xi is inferior to the Si system and the integrated diathermy system and automated set up are quirky. All require experience to overcome.

Conclusion: There is a learning curve to progress from the Si to Xi Da Vinci surgical platforms but this does not negatively impact outcome.

Keywords: Robotic surgery; Davinci Xi

Introduction

The Da Vinci robot has evolved, from S, to Si and now Xi. The Da Vinci Xi now provides 3D-camera developments and the addition of "force feedback", articulated instruments. So how can we take best advantage of this to improve outcomes whilst taking into account our learning curve?

Through a better site recognition, 3 D- stable view, magnification of the operation field with improved ergonomics it is possible not only to learn and to teach laparoscopic surgical anatomy in a fascinating direct way, but also to perform advanced laparoscopic operations, to a much larger extent in benign and oncological situations [1]. The da Vinci Xi robotic platform helps operating room personnel with smooth movement. Additionally, easy patient access is achieved with a side-docking facility with the help of the boom feature [2]. Side docking is also possible with the Si system. For the novice surgeon, arm collision can be a significant issue [2]. The patient clearance feature can be used to avoid this. Where access is difficult due to elevated BMI, modifications can be made through reassigning the camera to a different port with utilisation of the retargeting feature of the da Vinci Xi [2]. Robotic radical nephrouretrectomy is a procedure on the upper and lower tract. Single docking and single robotic port placement has evolved with the development of different generations of the robotic system [2]. These procedures can be performed safely and effectively using the da Vinci S, Si or Xi robotic platform [2]. The new da Vinci Xi robotic platform is intuitive for surgeons using its features and allows a single docking [2]. Due to the length of instruments, the urinary tract can be accessed anywhere along its length. Not only does this new model allow for improved access and approaches, but also has improved dexterity and haptic feedback. We review outcomes transitioning from the Si to Xi and review our learning curve.

Methods

This is a comparison of an initial series of 42 RARPs with the Xi system (2015) with a series using the Si system immediately before Xi uptake in the same calendar year and an Si series by

Table 1: Results of Si compared to Xi.

	Si Pre Xi	Xi post Si	Si synchronous with Si
N	81	42	27
PSA	9.3	7.6	8.3
Pre Gleason ≤ 3+4	60%	50%	48%
Pre Gleason ≥ 4+3	40%	50%	52%
Op Time (mins)	106	117	101
node dissection (% of cases with a node dissection)	37%	43%	44%
Blood loss (mls)	196	170	141
pT2/pT3	44%/56%	40%/60%	59%/41%
Overall +ve SM	12%	12%	11%
T2 +ve SM	7%	6%	6%
T3 +ve SM	19%	17%	9%

the same surgeon in a single centre. This was done synchronously as the Xi series using operative time, blood loss and positive margins as surrogates of surgical performance.

Results

For results please see Table 1. Subjectively and objectively there is a learning curve to Xi uptake in longer operative times but no impact on T2 positive margins which are the most reflective single measure of RARP outcomes. Subjectively the vision of the Xi is inferior to the Si system and the integrated diathermy system and automated set up are quirky. All require experience to overcome.

Discussion

The original S model, only had one set-up joint, this was replaced by two setup joints in the Si. The boom feature in the Xi allows precision of movement, easier positioning and ergonomically it glides. The 'plug and play' feature of no white balance or calibration is also very attractive to a surgical team. It has an 80 degree field of view, compared to 60 degrees in the Si, and with the Xi, the surgeon can change the angle automatically, with a 30 degree scope up or down. Both cameras have 1080 pixels. This further contributes to the robots' versatility. The Xi 8mm camera allows access down any port. This again allows for a greater versatility in the approach to the patient. However, in contrast to this questions have arisen regarding optical quality. The Si has a 12 mm camera, compared to an 8 mm one. Can an 8 mm camera provide the same resolution or quality? Additionally, the Xi has a chip in the camera tip and has a focal distance, similar to autofocus. In contrast to the Si, the autofocus may be more limited

compared to manual focus. With increased versatility and wider angles of vision, this may compromise acuity. This is better than the DaVinci S but not as good as the Si. This has previously been found to be an issue, however, with a subsequent software upgrade this resolved [2]. The side docking which can also be done with the Si allows for easy access to the pelvis. This makes examining the rectum very easy and thorough which can be very important in radical prostatectomy with wide local excision or any case where extra confidence is needed. Rectal injury is uncommon but when missed is a disaster so anything that lessens this risk is a great asset. The improved access and versatility of the da Vinci Xi could be applied to patient's undergoing further robotic surgery [3]. The DaVinci Xi allows -dissection from the renal hilum to the prostate without the need for re-docking or additional port placement [3]. The Da Vinci Xi facilitates difficult surgery, robotic RPLND without the need for re-docking or additional ports [3]. Sentinel nodes and lymph channels can also be easily identified with da Vinci Xi system [4] as Firefly is automatically built in. With the Si, an upgrade is needed. Sentinel node mapping is an easy and acceptable method with Da Vinci Xi in pelvic surgery [4]. This method has previously been conducted using isosulphan blue [4]. Robotic pelvic surgery has distinct advantages over laparoscopy. The latest Da Vinci Xi system is enabled with newer features such as longer arms to enable this to be possible.

Conclusion

In conclusion, the Xi does allow the surgeon a wider range of approach and manoeuvrability within patient care. There is a degree of compromise with the new optical system. There is a learning curve to progress from the Si to Xi da Vinci surgical platforms but this does not negatively impact outcome.

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