



Advancing Patient Care : Robotic Surgery Cases Catalog and Insights from a Tertiary Care Centre

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ABSTRACT

PURPOSE – Minimal invasive approach like robotics have precise anatomical interference, minimal instrumentation enhancing faster postoperative recovery, lesser pain, blood loss . Robotic-assisted surgery has revolutionized the field of gynecologic oncology, offering improved precision, dexterity, and visualization. In this article, we present our experience with 162 robotic surgeries using the da Vinci Xi system. We discuss surgical outcomes, complications, and advancements in the field, highlighting the benefits, challenges in the management of gynecological malignancies.

METHODS – Data was collected retrospectively for robotic assisted gynaecological, gynaecological procedures from 2021 - 2024 April . Operative time, mean blood loss, hospital stay, perioperative complications, histopathology reports were analyzed .

RESULTS – 162 patients were studied, comprising 94 benign pathology and 68 malignancies. In benign cases, robotic hysterectomies (85), ovarian cystectomies (7), sacrocolpopexy (1), colpopectopexy (1) . 68 malignancies included type 2, type 3 radical hysterectomies , robotic assisted video endoscopic inguinal lymphadenectomy (RA – VEIL) and pelvic, paraaortic, inguinal lymph nodes dissection . The mean hospital stay was 24 hours postoperatively with estimated blood loss of 25 ml in benign, 60 – 80 ml for malignant cases . We faced 2 intraoperative complications . Our nodal yield was an average 35 nodes using the sensitive firefly technique .

CONCLUSIONS - Our experience can reinforce the feasibility, technical superiority, skills of robotics in gynaecology and gynaecological .

KEYWORDS – Radical hysterectomy, Sentinel, robotic assisted video endoscopic VEIL.

Introduction and Background

The very first robotic surgery was performed by an orthopaedician in 1983 in Canada . While originally formulated for replacing surgeon's physical presence on a battlefield for wounded soldiers ,and in space missions to accompany astronauts, these systems have come a long way . The technology has been evolved from PROBOT (first prostate surgical robot) to ZEUS Robotic surgical system and now Da Vinci' latest system of Xi which has 3D perception, universal arm feature, near infrared for sentinel lymph node detection, master paddle technique, multiquadrant surgical field approach, more enhanced ergonomics to revolutionize area of minimal invasive approach in surgery .

The FDA approved RALS (Robot assisted laparoscopic surgery) for gynaecological diseases in 2005 . In India robots were introduced in 2011, since then now we have progressed to various systems like SSI MANTRA, HUGO RAS, CMR VERSIUS which have resulted in a burst of adaptability for this technique in area of gynecology including malignant cases . This retrospective observational study aims to analyze the prospects and feasibility of using robots in past 2.5 yrs in a superspeciality tertiary care setup of India and future course .

Materials and Methods

The data has been collected from our operated cases at 2 tertiary centers in Delhi, India from September 2021 to April 2024 (Max Superspeciality Hospital Vaishali, Patparganj) . Both have Da Vinci Xi system installed. Standard preoperative workup was performed in these cases with due consideration to patient factors like BMI, age, diagnosis, financial accessibility and in concordance with NCCN guidelines for malignant cases . An informed written consent regarding procedure, risk of conversion to laparotomy were well explained and documented .

We standardized our port positions as follows –

1. One supraumbilical 8 mm port for inserting 30 degree camera
2. Two 8 mm ports atleast at a distance of 6 – 8 cms from supraumbilical one and in between in a linear vector at right side of patient .
3. One 8 mm port on left at 6 – 8 cms apart from supraumbilical linearly and one 12 mm assistant port at an equivalent triangle from this and supraumbilical port .

These port placement were guided by Da Vinci Xi manual for maximizing precision, dexterity, ergonomics of team and minimizing master arm clashes and undue faults .

A Pelvic Left position / anatomy was selected in patient cart helm. We have recorded following in all of our surgeries –

1. Operating console time with time required in shifting, positioning, inducing .
2. Blood loss
3. Intraoperative, postoperative complications
4. Robotic docking time
5. Conversion to laparoscopy / laparotomy
6. Histopathology reports
7. Patient particulars like age, BMI, preoperative diagnosis, registration number ,duration of stay postoperative in hospital .

Results

A total of 162 patients were studied, out of which 94 were procedures done for benign conditions like leiomyoma, adenomyosis, endometriosis and 68 were malignant cases. In benign cases, robotic hysterectomies were 85, ovarian cystectomies were 7 including endometrioma, mature teratoma, serous cystadenoma .We also performed surgeries for prolapse like sacrocolpopexy, and colpopectopexy with good postoperative results .

Out of 68 malignant cases type 2 were done for endometrial cancer, type 3 radical hysterectomies for carcinoma cervix were performed including pelvic, inguinal, paraaortic lymph nodes dissection.

Table 1 : Patients characteristics

AGE (MEDIAN RANGE)	NUMBER OF CASES (N)
40 – 50 YRS	21
51 – 60 YRS	96
61 AND ABOVE	44
BMI (MEDIAN RANGE)	
< 23 .0	35
23.0 – 24.9	52
>/ = 25	74
HISTOLOGY	

ENDOMETRIOID ADENOCARCINOMA OF ENDOMETRIUM	55
GRADE 1	32
GRADE 2	19
GRADE 3	04
SQUAMOUS CELL CA OF CERVIX	02
CARCINOSARCOMA UTERUS	02
ADENOCARCINOMA CERVIX	03
HSIL CERVIX	04
GRANULOSA CELL TUMOR OF OVARY	01
SEROUS CYSTADENOMA OF OVARY	04
MATURE CYSTIC TERATOMA	03
CLEAR CELL CARCINOMA OF UTERUS	01
BRENNERS TUMOR OF OVARY	01
SENTINEL LYMPH NODE DISSECTION (N)	63
NO. OF SENTINEL NODES DETECTED POSITIVE FOR METASTASIS	03
SQUAMOUS CELL CARCINOMA OF VULVA	01

TABLE 2 : Comparison of data with previous studies

	Present study	Shashoua et al ¹⁰ , 2009	Payne et al, ¹¹ 2008	Giep et al , ¹² 2010	Sarlos et al , ¹³ 2010	Puntambekar et al ¹⁴ , 2014
No. of cases	162	24	100	23	40	80
Conversion rates	none	None	4%	1.7 %	none	None
Duration of study	2021 – MARCH 2024	2005 – 2007	2006 - 2007	2007 - 2009	2007 - 2009	2012 - 2013
Operative time (min)	90	142	119	90	109	80
Estimated blood loss (ml)	40	1.9 Hb drop	61	59	< 50	20
Hospital stay (days)	1	1	1	1	3.1	1
Intraop complications	1.2 %	None	1/100	1/237	none	None
Postoperative complications	Major none, Minor 1 / 160	Major none Minor 1/24	Major none, Minor 1/100	Major 2, minor 6/237	Major none, minor 5/40	None

TABLE 3: Comparison of radical hysterectomies with previous studies

Author	Kim et al ⁶ ,	Bogges et al, ⁷	Nezhat et al, ⁸	Lowe et al, ⁹	Puntambekar et al, ¹⁰	Present study
Cases	10	51	13	42	37	68
Operative time (min)	207	210	323	215	122	90
Blood loss (ml)	200 - 450	96.5	157	50	50 - 100	60 – 80
Nodal yield	28	33.8	25	25	30	35
Complication rate	10.0	7.8	Not known	16.8	7.4	1.2

Dependable and independable variables were analyzed by using Microsoft Office Excel Version 2021 .There was no statistical tests applied as this was purely descriptive study . In this study which was done over 2.5 years from September 2021 to April 2024 in a tertiary care centre , the average operative time was 90 minutes. There were 2 intraoperative complications one about urinary bladder and one ureteric injury which were in the initial phases of using Da Vinci surgical system and with time our skills have evolved accordingly . One vesicovaginal fistula was managed conservatively and it was healed within 3 months of operation . These were the 2 cases which resulted in complication.

Table 4 : Overview of our robot assisted surgeries

Robotic assisted hysterectomy + bilateral salpinx oophorectomy	85
Robotic assisted ovarian cystectomies	7
Robotic assisted sacrocolpopexy	1
Robotic assisted type 2 radical hysterectomy (includes pelvic lymph node dissection)	61
Robotic assisted type 3 radical hysterectomy (includes parametrectomy)	6
Robotic assisted colpopopectomy	1
Robotic assisted retroperitoneal lymph node dissection	1
Robotic assisted video endoscopic inguinal lymphadenectomy	1

Discussion

This study has included 162 cases done over last 2.5 years since 2021, from the time when Da Vinci Xi system had been installed at Max Super speciality Hospital, Vaishali and Patparganj . We have compared our data with previous similar studies and the number included in our study . The aim was to elucidate the feasibility, ergonomics, benefits to both a surgeon and patient undertaking a robotic surgery .

The operative time of 90 min is similar to that of Giep et al, and hospital duration of 2 days has been the protocol as cases are being admitted one day prior but are being discharged after 24 hours of surgery quite in concordance with other studies . There were 2 cases of complication in which injury to bladder, ureter occurred but these were in initial phase of learning curve .

Estimated blood loss is also quite less as when compared to laparoscopic, open procedures . In oncology cases we are reporting a total of 68 cases which is by far the maximum reported in any Indian study . Da Vinci Xi surgical system provides an extra edge in identifying sentinel lymph node by sensitive firefly technique enabling a surgeon to delineate the node .

In 2002, the use of Da Vinci robot for hysterectomies was first reported .Since then the area of minimal invasive approach has been rejuvenated since this technology makes a complex surgical task more accessible to surgeons without much laparoscopic experience. Robotic assisted laparo -endoscopic surgery is increasingly being accepted by public as it offers minimum post operative pain, faster recovery and least hospital stay and at the same time improving dexterity, articulation and precise movements by a surgeon .

In cases with high BMI , narrow pelvis, and even in interval debulking surgery for advanced epithelial ovarian cancers, Inguinal lymph node dissection, procedures like colpopectomy and sacrocolpopexy are to name a few where robotic surgeries have carved a niche .

Future progress in robotics will focus primarily on haptic systems that would provide tactile and kinesthetic input, micro- robotics, improving visual feedback with higher fidelity detail and magnification, autonomous robots .

This study was purely a descriptive one with its own share of limitations like lacking comparative data between laparoscopic and robotic assisted cases . A multicentric and a larger number of data could have been evaluated more extensively . Having said that our study is by far the largest one in Indian scenario so far within a duration of 2.5 years, and our experience has envisioned us further in performing complex pelvic surgeries .

Conclusion

Da Vinci Xi surgical system is newer and have various features like thinner instrument arms, longer instruments, option to switch camera to any port and greater flexibility in terms of direction and maneuvering. Several early preclinical animal based studies have demonstrated feasibility in SPORT Surgical system featuring 3D- HD visualization, with single arm system .

The dynamic landscape of robotic surgery in gynecology is poised for further advancements, and presents a paradigm shift in patient care, outcomes, surgeon comfort, and adaptability to diverse procedures .

Conflict of Interest: None

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Financial interests - The authors have no relevant financial or non financial interests to disclose .

Ethical approval and consent – This is an observational study. The ethical committee has confirmed that no ethical approval is required.

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