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Original Research Article

Four years, single surgeon, 114 robotic gynecological surgeries: an institutional audit from India with the Cambridge medical robotics Versius robot

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ABSTRACT

Background: Robotic-assisted surgery is transforming minimally invasive gynecology by offering enhanced precision, superior visualization, and ergonomic advantages over conventional laparoscopy. The Versius surgical system is a newer, modular alternative with lower infrastructure needs. However, published evidence on Versius use in gynecological surgery, particularly from India, is limited. This study evaluates a single-centre, single-surgeon experience with the Versius system over four years. Objectives were to assess the safety, feasibility, and effectiveness of robotic gynecological surgeries performed using the Versius system at a tertiary hospital in Delhi, India, over a 4-year period.
Methods: A retrospective review covered 114 consecutive benign gynecological procedures performed using Versius between July 2021 and July 2025 at PSRI hospital, Delhi. Data on patient demographics, surgical types, operative times, blood loss, complications, and hospital stay were analyzed.
Results: Robotic hysterectomy was the most common procedure (61.4%), followed by myomectomy (15%) and endometriosis surgery (12%). The mean operative time for hysterectomy was 174 minutes. Blood loss was ≤100 mL in 78% of cases. Intraoperative complications occurred in 7.9%, primarily hemorrhage, with two conversions to open or laparoscopic surgery. Postoperative recovery was uneventful in 97.5%, with a mean hospital stay of 1.08 days; most (91%) were discharged within 24 hours.
Conclusions: Versius robotic gynecological surgery is safe, feasible, and effective in an Indian tertiary setting, highlighting its promise as a cost-effective platform with low complications, minimal blood loss, and short hospital stays.

Keywords: Robotic hysterectomy, Endoscopic surgery, Versius, Gynecological, Laparoscopy, Robotic myomectomy, Endometriosis surgery

INTRODUCTION

Robotic-assisted surgery has become a new frontier in minimally invasive gynecology, a field where precision has redefined surgical outcomes. What once involved rigid instruments and two-dimensional vision has now been transformed into an art of finesse, offering surgeons enhanced dexterity, tremor filtration and high-definition visualisation.[1,2] In several ways, robotics has transformed the surgeon's console into a painter's easel, where delicate strokes define the outcomes and every movement extends beyond human limitation.

The use of robotics in surgery can be traced back to the late 1980s, when systems were developed not in hospital operating theatres but in military and space engineering scenarios to perform remote interventions.[3] The first food and drug administration (FDA)-approved robotic platform-the da Vinci surgical system, introduced in 2000-was a turning point, ushering in an era where

hysterectomies, myomectomies and endometriosis resections were performed with unmatched precision.[4]

Two decades on, robotic platforms have matured, redefining the possibilities in gynecology. Favourable clinical outcomes, such as reduced intra-operative blood loss, shorter hospital stays and faster recovery, are now widely reported, particularly in patients with obesity or anatomical complexity.[5,6] Yet, challenges remain in the form of high costs, long setup times and steep learning curves.[7,8] Ethical questions further shadow their rise: should novel technologies be adopted without ascertaining their superiority, and how can equitable access be ensured across diverse healthcare settings.[9]

Regulatory agencies, such as the U.S. FDA, continue to advise caution, supporting innovation but warning against unproven applications, particularly in oncological gynecology.[10] Meanwhile, newer platforms such as the Versius® surgical robotic system (CMR surgical, UK) have emerged, offering modularity, portability and an ergonomically designed open console to enhance adaptability and reduce surgeon fatigue.[11,12]

As robotic surgery advances, its future in gynecology depends on striking a balance between innovation and evidence, ensuring equitable access and providing ethical, patient-centred care so that technology serves not merely the privileged few but all who seek healing with dignity.

Aims and objectives

The present study was conducted with the following aims and objectives: to audit the incidence and pattern of intra-operative and post-operative complications in robotic-assisted gynecological surgeries performed using the Versius surgical system in a tertiary care setting, to compare peri-operative outcomes (such as operative time, blood loss, hospital stay, complications, and conversion rates) from the Versius system with published results from other major robotic surgical platforms and international centres, to evaluate the overall feasibility, safety, and effectiveness of the Versius robotic system for benign gynecological surgeries in terms of clinical outcomes, patient recovery, and applicability in the Indian healthcare context, to assess instrument usage patterns and technical workflows unique to the Versius platform for various gynecological procedures and to contribute real-world, single-centre data on the Versius system, enriching the limited literature and informing future robotic surgery adoption and research.

METHODS

This retrospective audit was conducted in the department of gynecological endoscopy at a tertiary care hospital in Delhi. The medical records of all patients who underwent benign gynecological surgeries with the Versius Surgical System between July 2021 and July 2025 were analysed. Consecutive cases were reviewed to capture baseline demographics, clinical characteristics and peri-operative outcomes. Baseline variables included age, parity, presenting complaints, body mass index (BMI), co-morbidities, prior surgical history, pre-operative diagnosis and the specific robotic procedure performed.

Intra-operative data-such as total console time, active console time and instrument (bipolar forceps, fenestrated grasper, monopolar scissors, monopolar hook and needle holder) usage duration-were extracted from the Versius system records. Additionally, peri-operative details, including estimated blood loss, pre- and post-operative haemoglobin levels, intra-operative and post-operative complications and hospital stay, were collected from the case sheets obtained from medical records department and analysed retrospectively. All procedures were performed by a single experienced surgeon, ensuring standardisation and consistency across cases. Patient identifiers were removed, and all data were fully anonymised to maintain confidentiality.

Inclusion criteria

All patients attending the gynecology outpatient department who required surgical management for gynecological disorders and provided written informed consent were enrolled in the study.

Exclusion criteria

Patients who declined participation or did not provide written informed consent were excluded from the study.

Surgical technique

All patients underwent a standard pre-operative assessment in accordance with routine protocols for gynecological surgery. Written informed consent was obtained on the day of the surgery. Pre-operative bowel preparation was performed the previous night using oral charcoal and bisacodyl tablets, along with 0.25 mg of alprazolam for anxiolysis. The procedures were conducted with the three-arm Versius robotic system (CMR surgical, UK) (Figure 1).

Following induction of anesthesia, the patients were placed in a semi-lithotomy position and the operative field was prepared and draped. A 30° endoscope and a vaginal manipulator with colpotomiser were routinely employed.

Standard port placement included a supra-umbilical 10-mm camera port, two 5-mm accessory ports lateral to the main port and an additional 5-mm assistant port on the left. The robot was docked to the camera and the main right and left ports. Most surgeries were successfully performed with the three-arm configuration. The operating table was tilted to a Trendelenburg (head-low) position for optimal visualisation of the uterus and adnexa. Vaginal vault closure, when indicated, was performed using V-Loc™ 1-0 sutures.

Figure 1: Three-arm Versius robotic system (CMR surgical, UK).

Statistical analysis

The data were systematically recorded on a pre-designed data collection form. This was a retrospective study, with clinical data obtained from the medical records department and detailed intra-operative parameters extracted from Versius system records. Categorical variables were presented as frequencies and percentages, whereas continuous variables were expressed as means with corresponding standard deviations. Kobo toolbox and Microsoft excel 2021 were employed for data tabulation and management. As this study was a descriptive audit, inferential statistical tests were not performed.

RESULTS

The audit of robotic gynecological surgeries performed at PSRI hospital, Delhi, included 114 cases and provided detailed information on patient demographics, surgical indications, procedures, intra-operative parameters, complications and duration of hospital stay. The mean patient age was 43.6 years (range, 20-85), with the majority in the 40-50 years age group, reflecting a peri- and post-menopausal cohort. The predominant clinical presentation was heavy menstrual bleeding, either alone or combined with dysmenorrhoea and pelvic pain, together accounting for >80 (70%) surgical indications. A smaller proportion of patients presented with infertility, pelvic organ prolapse, post-menopausal bleeding or complex symptom clusters (Table 1).

Nearly half of the patients had no co-morbidities, while the most common medical illnesses were hypothyroidism, diabetes and hypertension, either singly or in combination. A small proportion of patients presented with multiple, complex medical conditions. Despite such variations in the baseline health status, the surgical outcomes showed a favourable profile across the cohort (Table 2).

Table 1: Patient characteristics.

Characteristics	Details/statistics
Number of patients	114
Mean age	43.6 years
Parity	Range-0-5 (varied parities included)
Common presenting complaints	Heavy menstrual bleeding (>70%), dysmenorrhea, pelvic pain, infertility, post-menopausal bleeding, pelvic organ prolapse

Table 2: Co-morbidities of patients undergoing robotic gynaecological surgeries.

Co-morbidity	N
None	56
Hypothyroidism	20
Diabetes	8
Hypertension	3
Cardiac disease	2
Others (Seizures, bronchial asthma, TB)	3
Multiple co-morbidities ≥2	21
Total	114

Table 3: Types of gynaecological robotic surgeries performed and their average duration and their average duration.

Type of surgery	N	Average duration (mins)
Robotic hysterectomy + BSO	65	185.58
Robotic myomectomy	17	91.33
Robotic endometriosis surgery	14	88.62
Robotic hysterectomy + pelvic floor repair	5	162.42
Robotic cystectomy	4	155.2
Robotic myomectomy + robotic endometriosis surgery	3	143.3
Diagnostic and operative robotic-assisted laparoscopy with PCO drilling and chromopertubation	1	61.0
Robotic endometriosis surgery + robotic salpingectomy	1	30.0
Robotic cystectomy + robotic salpingectomy	1	122
Robotic hematometra drainage	1	49
Robotic salpingectomy for ectopic	1	61
Robotic adenomyomectomy	1	40
Total	114	149.84

BSO-Bilateral salpingo-oophorectomy, PCO-polycystic ovary

The most frequently performed operation was robotic hysterectomy with BSO or pelvic floor repair (PFR), accounting for 70 cases (65+5=70, 61.40%), followed by robotic myomectomy (17 cases, 14.91%) and robotic

endometriosis surgery (14 cases, 12.28%), with fewer cases of cystectomy, combined procedures and rare interventions such as adenomyomectomy and salpingectomy.

The operative duration varied by surgery type, with mean times of 185.6 min for hysterectomy with BSO, 91.3 min for myomectomy and 88.6 min for endometriosis surgery. Specialised combined procedures exhibited variable times ranging from 30 to 155 min. Previous abdominal or pelvic surgeries, such as caesarean section, myomectomy, or endometriosis surgery, were associated with an increase in average duration, particularly in patients with multiple prior operations (Table 3).

Intra-operative blood loss was minimal in most cases, with 71 patients (61.4%) recording <50 mL and over 90 patients (78%) recording <100 mL. Robotic hysterectomies demonstrated the lowest bleeding risk, while robotic myomectomies and cystectomies showed slightly higher blood loss, which is consistent with their technical complexity (Table 4).

The overall complication profile was low and dominated by intra-operative haemorrhage, which occurred in 16 cases but was successfully managed without recurrence post-operatively. Only two conversions were necessitated (one each to laparotomy and laparoscopy). Post-operative adverse events were rare, with two patients requiring ICU admission or prolonged stay and just one case of fever with urinary tract infection. Surgery-specific risks were concentrated in myomectomy and combined procedures, where haemorrhage accounted for most complications, increasing the overall event rate in these groups compared with hysterectomy or cystectomy, which demonstrated excellent safety records.

Instrument usage data revealed that bipolar cautery and monopolar scissors accounted for the highest proportion of console time, followed by monopolar hook and suturing instruments such as the needle holder, indicating their central role in dissection and haemostasis. Patterns of use varied by procedure, with the longest durations recorded during hysterectomy and myomectomy (Table 5).

The hospital stay was uniformly short, with a mean of 1.08 days and a median of 24 h. Over 104 patients (91%) were discharged within 24 h, and only 8 cases required a longer admission of up to 72 h, most often due to co-morbidities or peri-operative complications. Even in the presence of common single co-morbidities such as diabetes, hypertension or hypothyroidism, the overwhelming majority of patients were discharged after 1 day. Prolonged admissions were limited to those with multiple severe co-morbidities, such as cardiac disease, renal dysfunction or asthma in combination with complex surgical procedures.

Table 4: Blood loss distribution.

Blood loss volume	Percent of all cases
<50 ml	61.4%, (n=71)
50-100 ml	16.7%, (n=19)
100-250 ml	8.8%, (n=11)
250-500 ml	5.3%, (n=6)
>500 ml	6.1%, (n=7)

Table 5: Types of gynecological robotic surgeries performed and their average duration of instrument usage.

Surgery type	Bipolar (min)	Fenestrated grasper (min)	Monopolar scissors (min)	Monopolar hook (min)	Needle holder (min)
Robotic hysterectomy + BSO	124.1	16.7	76.2	31.9	22.4
Robotic myomectomy	49.2	8.6	35.4	12.4	25.2
Robotic endometriosis surgery	55.8	4.8	50.6	2.8	7.5
Robotic hysterectomy + PFR	117.6	15.4	72.0	38.8	16.2
Robotic cystectomy	37.8	17.3	17.8	2.3	0.0
Robotic myomectomy + robotic endometriosis surgery	81.0	27.7	56.0	0.0	37.7
Robotic cystectomy + robotic salpingectomy	29.0	6.0	21.0	0.0	0.0
Robotic hematometra drainage	10.0	21.0	0.0	16.0	53.0
Robotic salpingectomy for ectopic	43.0	25.0	17.0	0.0	0.0
Robotic endometriosis surgery+ robotic salpingectomy	28.0	19.0	8.0	0.0	0.0
Diagnostic and operative robotic-assisted laparoscopy with PCO drilling and chromopertubation	86.0	4.0	52.0	26.0	0.0
Robotic adenomyomectomy	40.0	NA	NA	NA	NA

DISCUSSION

The present audit of 114 robotic-assisted gynecological surgeries performed at PSRI hospital, Delhi, offers a valuable snapshot of the integration of robotic technology into a high-volume tertiary care gynecological practice. Our study effectively highlights the efficiencies of the CMR Versius surgical system in comparison with other contemporary data from India and abroad, particularly in relation to the da Vinci platform.

Our study demonstrated a significant reduction in the average operative time of 149.84 min which is substantially shorter than the times reported by Rajanbabu et al (165 min), Kadioglu et al (166 min) and Goetgheluck et al (184.25 min).[14-16] The diversity of procedures in this study including robotic surgeries for indications with inherently shorter durations such as cystectomy, salpingectomy, adenomyomectomy, endometriosis surgery, hematometra drainage, and procedures like PCO drilling and chromopertubation, contributed to a lower mean operative time. The inclusion of these less time-intensive surgeries, alongside more complex cases, resulted in a significantly reduced average operating time compared to other published series.

The estimated blood loss was <50 mL in 71 patients (61.4%). Other studies have reported a range of 93-114 mL, or the blood loss was estimated indirectly based on the fall in haemoglobin level (Rooma et al).[13] Reduced blood loss reflects a meticulous surgical technique enabled by the robotic platform and efficient haemostatic control, ensuring patient safety.

The length of hospital stay is another key indicator of recovery efficiency. Our average hospital stay of 26.5 h is markedly shorter than the durations reported by other centres in India (Rooma et al 3.1 days; Kadioglu et al 4 days) and France (Goetgheluck et al 2.45 days).[13,15,16] This shorter stay likely reflects enhanced recovery protocols and the advantages of minimally invasive robotic surgery. It translates into reduced inpatient costs and improved patient satisfaction.

All studies have reported very low intra-operative and post-operative complications. The PSRI audit revealed no intra-operative complications and only three minor post-operative complications (fever requiring antibiotic administration and intensive care unit admission due to multiple co-morbidities), with no major events, indicating robust safety comparable to or better than that of other published series. Conversion rates were low (2 patients, 1.75%); the rates were slightly higher than those reported by Rooma et al (2 patients, 0.44%) and Goetgheluck et al (2 patients, 1.96%) but lower than those of Kadioglu et al (2 patients, 5%).[13,15,16] This rate is acceptable given the high complexity often encountered in tertiary referral centres (Table 6).

Table 6: Comparison of robotic gynecological surgeries with other studies.

Authors	Present study	Rooma et al[13]	Rajanbabu et al[14]	Kadioglu et al[15]	Goetgheluck et al[16]
No. of cases	114	452	655	40	102
Type of surgery	Benign gynecological conditions	Benign gynecological conditions	Benign and malignant gynecological conditions	Benign gynecological conditions	Benign gynecological conditions
Robotic system type	CMR Versius	Da Vinci	Da Vinci	Da Vinci XI	Da Vinci
Location	Delhi, India	Hyderabad, India	Kochi, Kerala	Turkey	Suresnes, France
Duration of study	2021-2025	2012-2021	2015-2019	2015-2017	2010-2012
Operative time (Avg., min)	149.84 min	106	165	166	184.25
Estimated blood loss	50 ml	1.1 gm Hb drop	100 ml	93 ml	114 ml
Hospital stays (days)	1.08	3.1	NA	4	2.45
Intra-operative complication	None	1/452	NA	2/40	2/102
Post-operative complication	3 minors, no major	1 minor, no major	NA	2 Major	2 Minor, 3 Major
Conversion rates	1.75% (n=2)	0.44% (n=2)	0%	5% (n=2)	1.96% (n=2)

Table 7: Comparison of robotic hysterectomy with other studies.

Authors	Present study	Patel et al[17]	Rooma et al[13]	Puntambekar et al[18]	Haveman et al[19]	Martinez et al[20]	Payne et al[21]
No. of cases	70	113	150	30	356	52	100
Type of surgery	RH	RH	RH	Radical hysterectomy	RH (Benign and malignant)	RH	RH
Robotic system type	CMR Versius	Da Vinci	Da Vinci	CMR Versius	Da Vinci	Da Vinci	Da Vinci
Duration of study	2021-2025	2021-2024	2012-2021	2009-2014	2011-2019	2008-2009	2006-2007
Operative time (Average, min)	174	178.41	109.22	104	115	154.63	119
Estimated blood loss	50 ml	25 ml	0.95 gm Hb drop	60 ml	50 ml	0.9 gm Hb drop	61 ml
Hospital stays (days)	1	3	3.1	2.1	3	1.38	1
Intra-operative complication	None	None	1/452	None	6/356	1/52	1/100
Post-operative complication	3 minors, no major	2 minor, 1 major	1 minor, no major	0 minor, 2 major	13.3%	1 minor, no major	1 minor, no major
Conversion rates	2.85% (n=2)	None	0.44% (n=1)	None	2.80 % (n=10)	None	4% (n=4)

RH-Robotic hysterectomy; CMR-Cambridge medical robotics.

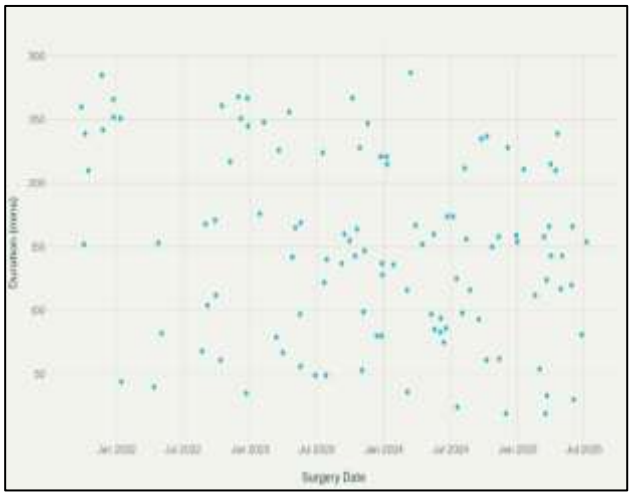

Figure 2: Scatter plot of average duration of robotic surgeries over the years.

The audit of our robotic hysterectomy cases using the CMR Versius surgical system (2021-2025, 70 cases) was benchmarked against six published series, most of which used the da Vinci platform. Our average operative time (174 min) was the higher, which could reflect the learning phase with a new robotic system. Studies with da Vinci (e.g., Rooma et al 109.22 min, Haveman et al 115 min) have reported shorter operative times, although Patel et al and Martinez et al had longer durations closer to ours.[13,17,19,20] The statistical fit on our dataset estimates an average operative time reduction of approximately 0.39% per consecutive case (95% confidence interval: 0.03% to 0.75%). This indicates a consistent but gradual improvement in efficiency with each additional surgery performed.

The estimated blood loss in our series (50 mL) was comparable to that in other studies, including Patel et al (25 mL), Haveman et al (50 mL) and Puntambekar et al (60 mL), suggesting consistency in surgical safety across platforms.[17-19] The length of hospital stay in our cases (1 day) was the shortest among all series, indicating a rapid recovery, whereas most other studies reported stays of 2-3 days.

Complications and conversion rates remained low and comparable to those in previous studies. No intra-operative complications occurred in our series, and our conversion rate (2 patients, 2.85%) was similar to that of Haveman et al (10 patients, 2.8%) and lower than that of Payne et al (4 patients, 4%).[19,21] Most post-operative complications were minor in all studies (Table 7).

The 2024 study by Manchanda et al conducted by one the researcher of this paper from 2021-2023, reported an average operative time of 150 minutes for robotic gynecological surgeries using the Versius system. In contrast, our current audit shows a significant reduction in average operative time to around 90 minutes. This marked decrease underscores the impact of accumulated surgical experience and practice, reflecting a learning curve effect where operative efficiency improves notably over time with continued use of the robotic platform. The progression from 150 to 90 minutes exemplifies enhanced proficiency and workflow optimization by the surgeon with growing familiarity and skill in robotic gynecologic surgery.[22]

Table 8: Cost comparison of the Versius robotic surgical system and the Da Vinci system in India.

Aspects	CMR Versius robotic system	Da Vinci robot (Intutive)
Initial installation	10-12 Crore ₹ (1 million USD)	16-20 Crore ₹ (2 million USD)
Annual maintenance	30-40 Lakh ₹ per annum	50 Lakh ₹ per annum
Cost per operation	80,000 ₹-1 lakhs ₹	1.5 lakh ₹-2 lakh ₹

The Versius system offers a more cost-effective and versatile option suitable for the Indian healthcare environment, featuring lower installation and per-case costs, smaller physical footprint, and surgeon-friendly ergonomics that reduce fatigue and shorten the learning curve. Its modular, portable design facilitates wider accessibility, even in smaller hospitals, potentially democratizing access to robotic surgery.

Strengths and limitations

This study is one of the first institutional audits of the Versius system in gynecological surgery from India, contributing valuable real-world evidence to the limited global literature on this topic. Including a range of benign procedures, such as hysterectomy, myomectomy and endometriosis surgery, provides a comprehensive assessment of clinical outcomes. The detailed reporting of console time, instrument usage, blood loss and hospital stay offers granular insights that are rarely documented in similar audits. The single-surgeon experience ensures uniformity in surgical technique, while the comprehensive operative data facilitate meaningful comparison with established robotic platforms. However, this study is limited by its retrospective design, single-centre setting and reliance on a single surgeon's experience, which may affect generalizability. Additionally, the relatively modest sample size and the absence of long-term follow-up or cost-effectiveness analysis limit the scope of the conclusions.

CONCLUSION

This 4-year audit of robotic gynecological surgeries using the Versius system at our tertiary care centre establishes its safety, feasibility and effectiveness in managing diverse benign gynecological conditions. The Versius robot, with its modular design, ergonomic open console and cost-conscious technology, offers a valuable alternative to existing platforms. This system is particularly well-suited to the Indian healthcare landscape, where affordability and accessibility are critical concerns. Robotic surgery enhances surgical precision, reduces blood loss, minimises complications and enables faster recovery-directly benefiting women's health by offering minimally invasive options with shorter hospital stays. This technology aligns well with India's economic priorities by potentially lowering overall healthcare costs and expanding surgical access beyond urban centres. Looking ahead, the integration of robotics with AI promises to revolutionise gynecological care via personalised surgery, improved outcomes and streamlined training, making advanced surgical care safer, more efficient and widely available to women across India and globally. However, large, high-quality randomised controlled trials that directly prove improved patient outcomes are currently lacking.

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