Original Research Article

Robot assisted hysterectomy - its benefits and advantages over other routes of hysterectomies: a retrospective cohort study

C. P. Dadhich[1], Nidhi Mehta[1]*, Tripti Dadhich[1], Surmil Sharma[1], Shweta Mangal[2]

[1]Department of Obstetrics and Gynecology, C. K. Birla Hospital, Jaipur, Rajasthan, India
[2]Department of Community Medicine, MGM Hospital, Jaipur, Rajasthan, India

*Correspondence:
Dr. Nidhi Mehta,
E-mail: drnidhimehta83@rediffmail.com

ABSTRACT

Background: Minimally invasive hysterectomy has become the preferred approach for benign gynecological conditions. Robot-assisted laparoscopic hysterectomy (RALH) has been introduced to overcome certain technical limitations of conventional laparoscopy.
Methods: This retrospective cohort study included 165 women undergoing hysterectomy for benign gynecological indications at a tertiary care center between November 2023 and February 2024. Patients underwent RALH, total laparoscopic hysterectomy (TLH), total abdominal hysterectomy (TAH) or vaginal hysterectomy (VH). Perioperative outcomes including operative time, estimated blood loss (EBL), length of hospital stay (LOS), postoperative pain scores (VAS) and complications were compared.
Results: Of the 165 cases, 43 underwent RALH, 64 TLH, 26 TAH and 32 VH. Baseline demographic parameters were comparable across groups. RALH was associated with significantly lower mean blood loss (8.49±5.51 ml), shorter hospital stay (1.3±0.4 days) and lower postoperative VAS scores compared to other routes (p<0.001). No conversions to laparotomy were required. Secondary hemorrhage was least frequent in the RALH group.
Conclusions: Robot-assisted hysterectomy demonstrates favorable perioperative outcomes in selected patients with benign gynecological conditions. While clinical differences were statistically significant, their impact should be interpreted in the context of patient selection and resource availability.

Keywords: Hysterectomy routes, Minimally invasive surgery, Perioperative outcomes, Robot-assisted hysterectomy

INTRODUCTION

Hysterectomy is one of the most commonly performed gynecological surgeries worldwide, with millions of procedures carried out annually for benign and malignant indications.[1]

The evolution of minimally invasive surgical techniques has significantly improved perioperative outcomes, including reduced blood loss, shorter hospital stay and faster recovery, as "minimally invasive approaches consistently demonstrate superior postoperative outcomes compared with open surgery" \Traditionally, hysterectomy was performed via abdominal or vaginal routes, however, advancements in laparoscopy have expanded surgical options for complex benign gynecological conditions.[2] Robot-assisted laparoscopic hysterectomy was approved for gynecological use by the United States Food and Drug Administration in 2005.[3]

Enhanced three-dimensional visualization, articulating instruments with increased degrees of freedom and improved surgeon ergonomics have facilitated its adoption, particularly in technically challenging cases, as robotic systems "allow greater precision and dexterity than conventional laparoscopy".[4] Despite these advantages, the role of robotic hysterectomy in routine benign gynecological practice remains debated due to concerns

regarding cost and comparable clinical outcomes.[5] This study aimed to compare perioperative outcomes of robot-assisted hysterectomy with other surgical routes for benign gynecological conditions in a tertiary care setting.

Aims and objectives

The main aim of this study is to describe the operative robotic hysterectomy and highlight its long-term benefits. The study also aims at comparing the robotic and other minimally invasive hysterectomies.

METHODS

Study design and setting

This retrospective cohort study was conducted at CK Birla Hospital and Research Institute, Jaipur, India, from November 2023 to February 2024.

Inclusion criteria

Women undergoing hysterectomy for benign gynecological indications like fibroids, adenomyosis, abnormal uterine bleeding, endometrial hyperplasia were included. Patients were grouped based on the surgical route RALH, TLH, TAH and VH.

Exclusion criteria

Patients with body mass index (BMI) >30 kg/m², gynecological malignancies, emergency obstetric hysterectomy or hysterectomy combined with other major surgical procedures were excluded.

Operative technique

Pre operative preparation

Nil by mouth 6 hrs prior to surgery, 2 tablets of Dulcolax in the night before surgery to clear their bowels, pre-anaesthetic check-up done and screened for use of blood thinners or other medications.

Anaesthesia and patient positioning

Patients are induced with general anaesthesia with endotracheal tube and positioned in dorsal lithotomy position with buttocks just off the table. The arms are tucked to side and secured in neutral position. The chest of patient is strapped to avoid slipping and some form of protection of face is usually done. The stomach is usually deflated with a nasogastric tube.

Uterine manipulation

It is usually done by assistant at the vaginal end and colpotomy cup sizes are chosen according to the size of the cervix and space at the vaginal introitus.

Trocar placement and docking

Operative steps of robot assisted laparascopic hysterectomy.

Data collection

Data were retrieved from electronic medical records and included patient demographics, uterine size, operative time, estimated blood loss, length of hospital stay, postoperative pain scores (VAS) and perioperative complications.

Statistical analysis

Statistical analysis was performed using SPSS software. Continuous variables were expressed as mean±standard deviation and compared using appropriate statistical tests. Categorical variables were analyzed using the chi-square test. A p value<0.05 was considered statistically significant.

Ethical approval

Approved by the institutional ethics committee.

RESULTS

This is a retrospective cohort study performed over a period of 3 months at our centre Rukmani Birla Hospital, Jaipur. The study was done at CK Birla Hospital Cum Research Institute from the period between November 2023 to February 2024 (3 months).

Out of 165 cases studied for hysterectomies performed for benign gynaecological conditions, 64 cases done as total laparoscopic hysterectomies, 43 were robot assisted hysterectomies, 26 were total abdominal hysterectomies and 32 cases performed vaginally. This is a retrospective cohort study performed over a period of 3 months at our centre Rukmani Birla Hospital, Jaipur.

All surgeries were performed by same surgeon and hence errors due to operator bias were excluded. Unbiasedly all robot or laparoscopic assisted surgeries were done by using bipolar and scissors thereby to exclude instrument related differences. Cases were studied and compared on basis of duration of procedure, estimated blood loss, length of hospital stay post-surgery, postoperative VAS scores and post operative secondary haemorrhage.

Statistical analysis was done and p value calculated for the above variables as shown in tables. The demographic profile of cases in terms of age and BMI and uterine size was shown in Table 1 they were almost similar in terms of mean age and BMI.
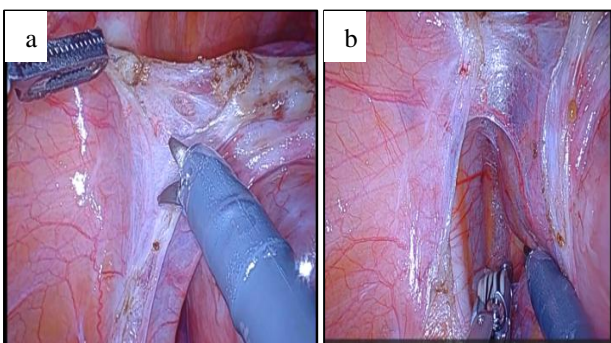
Uterine size was highest in cases of TAH AND lowest IN VH. This was found to be statistically significant.

Figure 1 (a-c): Robotic unit (surgeon console, patient cart, vision cart).
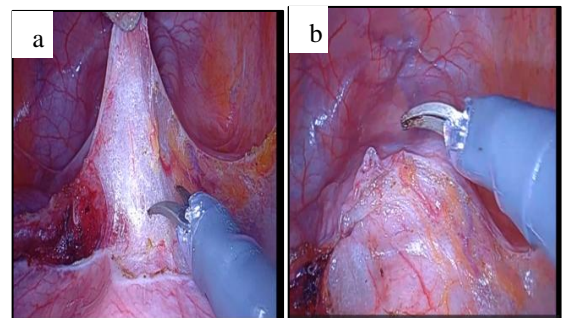

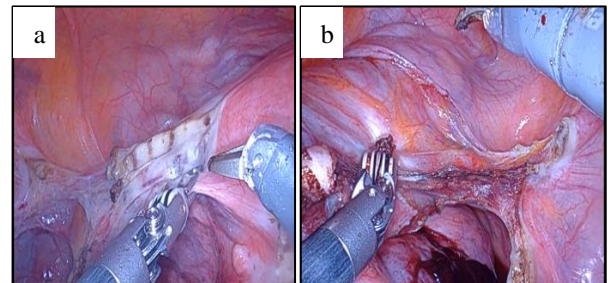**Figure 2: Sterile draping of robotic arms and docking.**

Figure 3 (a and b): Retroperitoneal dissection (round ligament cut near lateral pelvic wall) and Identification of major vessels and lateralization of ureters.
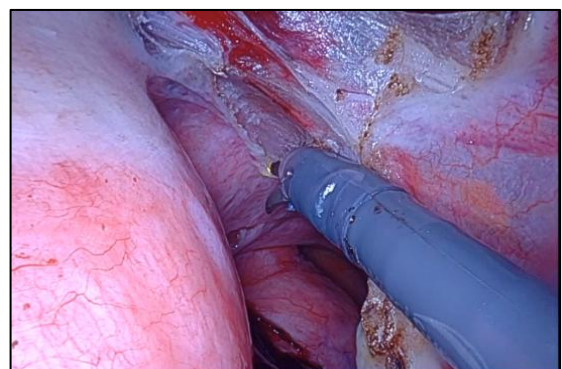

Figure 4: Cutting of opposite side round ligament.

Figure 5 (a and b): Dissection of anterior vesical peritoneum and bladder pushed down.
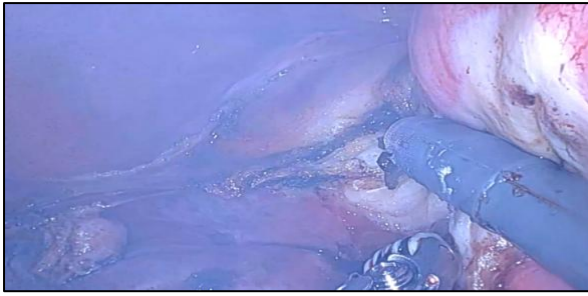

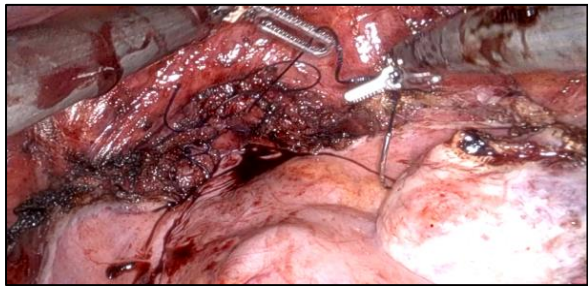**Figure 6 (a and b): Coagulation of bilateral uterine vessels.**

Figure 7: Opening of posterior leaf of broad ligament and proceed to cut bilateral uterosacral ligaments.

Figure 8: Cutting of vaginal vault.

Figure 9: Vaginal vault endosuturing.

On comparison mean blood loss following robot assisted hysterectomies was only ~8.49+/- 5.5 ml with the highest ranging from 17.03 to 27.59 ml in abdominal and vaginal hysterectomies. (p value 0.01), fond to be statistically significant.

The length of hospital stay was lowest in RTH Group (1.3-1.5 days average) as compared to that in TLH or TAH group (2-4 days), p value (<0.001). Post operative VAS score and rate of secondary haemorrhage was lowest in RTH Group (p value 0.001). Duration of procedure showed slight difference between RTH and TLH group but a significant difference with that of TAH OR VH Group (p value 0.003).

It was clearly shown that patients undergoing robot hysterectomies had the advantages of lowest blood loss, shorter duration of hospital stay, decreased use of postoperative analgesia with lowest VAS SCORE and fewer rates of complications. No case was subjected to conversion to laparotomy or readmission. Although statistically significant differences were observed, the clinical relevance of these findings should be interpreted cautiously.

Table 1: Demographic and health characteristics of reported cases.

	RTH (n=45)	TAH (n=24)	TLH (n=67)	VH (n=29)	P value
Age in years	45.91±3.52	48.25±4.56	46.27±3.39	46.69±5.96	0.148
BMI (Kg/m²)	21.2±1.1	20.9±1.4	21.1±1.2	21.5±1.1	0.295
Uterine size (weeks)	17.13±2.64	19.04±3.36	18.07±2.05	15.48±2.73	<0.001 (S)
P value compared to RTH		0.022 (S)	0.347	0.045 (S)	

Table 2: Surgical outcomes in relation to type of hysterectomy.

	RTH (n=45)	TAH (n=24)	TLH (n=67)	VH (n=29)	P value
Procedure duration (in hour)	1.48±1.94	2.48±0.8	1.7±0.56	1.95±0.39	0.005 (S)
P value compared to RTH		0.003 (S)	1.000	0.491	
Estimated blood loss (ml)	8.49±5.51	25.23±6.63	17.03±5.44	27.59±6.41	<0.001 (S)
P value compared to RTH		<0.001 (S)	<0.001 (S)	<0.001 (S)	
Length of stay (days)	1.3±0.4	3.08±0.82	2.37±0.5	2.66±0.52	<0.001 (S)
P value compared to RTH		<0.001 (S)	<0.001 (S)	<0.001 (S)	
VAS score	0.82±0.89	3.42±0.88	3.21±1.01	3.86±0.92	<0.001 (S)
P value compared to RTH		<0.001 (S)	<0.001 (S)	<0.001 (S)	

Table 3: Incidence of complications in relation to type of hysterectomy.

	RTH (n=45)	TAH (n=24)	TLH (n=67)	VH (n=29)	P value
Major complications	1 (2.2%)	1 (4.2%)	1 (1.5%)	0	0.978
Minor complications	0	0	1 (1.5%)	0	0.943
Secondary hemorrhage	2 (4.4%)	6 (25%)	11 (16.4%)	12 (41.4%)	0.001 (S)

DISCUSSION

Hysterectomy is the second most common surgery performed in women after caesarean section. In Indian Statistics, according to the National Family Health Survey (NFHS-5), 3% of women aged 15–49 in India have had a hysterectomy. However, the prevalence of hysterectomy varies by region, ranging from 1.2% in the Northeast to 4.2% in the South.[6] Other studies have found a higher prevalence of 11.35% overall and 14.6% among urban

women. Various metanalysis studies discuss the minimally invasive routes of hysterectomies to be more advantageous in terms of reduced hospital stay, fewer peri and postoperative morbidity, lower complications and quick recovery.[7] Abdominal hysterectomy allows improved visualization and tactile feedback of tissues but there is increased risk of bleeding, venous thromboembolism, post operative pain and colonic stasis.[8] Vaginal is the highly preferred mode of hysterectomy due to low cost, minimal invasion and high safety but with disadvantages of decreased vision and restricted ability to visualize adenexa.[9]

Laparoscopic hysterectomy has revolutionized the scenario in gynecology but certain patients with chronic medical illnesses may not tolerate Trendelenburg position or pneumoperitoneum with slightly higher rate of vaginal cuff dehiscence.[10] The introduction of robot assisted hysterectomies with its FDA approval in 2005 has proven to be more beneficial in cases of severe endometriosis, large or multiple fibroids and early stages of endometrial and cervical cancer, as compared to conventional laparoscopy and non -descent vaginal hysterectomies.[11]

Da vinci surgical system comprises of three components (Figure 1). A surgeon's console, a patient-side cart with four robotic arms manipulated by the surgeon (one to control the camera and three to manipulate instruments) and a high-definition three-dimensional (3D) vision system.[12] Articulating surgical instruments are mounted on the robotic arms, which are introduced into the body through cannula. The major benefits of robotic surgery are less blood loss, less pain and discomfort, less scarring, lower risk of infection, more precise surgery, quicker recovery, shorter hospital stays and enhanced vision. It ensures increased range of motion due to ability to move camera and 3D vision, Endo wrist movements with robotic instruments, better stabilization of instruments and improved ergonomics for surgeons.[13] The route of hysterectomy is often chosen by uterine weight and size, previous surgeries, pelvic adhesions and endometriosis, presence of uterine descent as well as body habitus and BMI of patient.[14] Analysis by Wright et al found similar rates of intraoperative and postoperative complications in robotic-assisted versus conventional laparoscopic hysterectomy.[15] Albright et al recently performed a systematic review and meta-analysis of randomized trials comparing the same groups and also found similar rates of mild, moderate and severe complications.[14]

Robotic compared with conventional laparoscopic hysterectomy: a randomized controlled trial. The change in preoperative to postoperative quality-of-life index (quality of life measured on a linear scale from 0 to 100) was significantly higher in the robotic group, with 13 (±10; 13) compared with 5 (±14; 5) (conventional group).[15] Cochrane review analysis of hysterectomy techniques highlighted the fewest intraopcomplications quick return to baseline activity and fewest number of urinary or bowel dysfunction or dyspareunia issues with vaginal approach.[16]

Although the analysis does show a statistically significant reduction in estimated blood loss and decreased duration of stay with the robotic-assisted route compared to other MIS routes, these complications were rare and the difference may not be clinically significant.

CONCLUSION

Robot-assisted hysterectomy is a feasible minimally invasive option for selected benign gynecological conditions, offering favorable perioperative outcomes. Appropriate patient selection, surgeon expertise and resource considerations remain essential. Robot assisted hysterectomies are beneficial and superior technique than other minimally invasive hysterectomies especially in cases of severe endometriosis, large or multiple fibroids, early stage endometrial and cervical carcinoma where extensive retroperitoneal dissection and lateralization of ureters is required.

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