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Original Research Article

Learning curve of laparoscopic hysterectomy in a zonal hospital setting: a retrospective analysis of 102 cases operated by a single surgeon

Praveen Kumar[1]*, Krishan Kapur[2], P. Mohan Bhat[3], Nikhil Karkhanis[4]

[1]Department of Obstetrics and Gynecology, ART Centre, Army Hospital (Research and Referral), New Delhi, India
[2]Department of Obstetrics and Gynecology, Base Hospital, New Delhi, India
[3]Department of Obstetrics and Gynecology, 166 Military Hospital, C/O 56 APO, Jammu, India
[4]Department of Anaesthesiology, Base hospital, Lucknow, Uttar Pradesh, India

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***Correspondence:**
Dr. Praveen Kumar,
E-mail: praveen2479@rediffmail.com

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ABSTRACT

Background: The aim of this study was to analyse the learning curve and clinical efficacy of the art of laparoscopic hysterectomy in a zonal hospital setting.
Methods: We conducted a retrospective analysis of 102 women who underwent laparoscopic hysterectomy (LAVH/ TLH) by a single surgeon after post-graduation for benign uterine pathology in a zonal hospital setting. They were divided into two groups of first 50 cases (Group I) and next 52 cases (Group II). The primary outcome was the learning curve of the operating gynaecologist in terms of reduction in duration of surgery, reduced perioperative complications, increasing percentage of TLHs with time.
Results: 102 women underwent laparoscopic hysterectomy for the benign uterine pathology successfully. Surgical outcomes of laparoscopic hysterectomy in terms of mean operative time was 135 mins (Group I) vs 93 mins (Group II), estimated blood loss 255 ml (Group I) vs 140 ml (Group II), hospital stay 05 days (Group I) vs 03 days (Group II), duration of postoperative analgesia 07 days (Group I) vs 05 days (Group II). As the surgical experience increased, patients with bigger uterine size (>10-week size) were taken up for hysterectomy, percentage of TLH increased in Group II as compared to Group I (42.31% vs 18%), with decreasing complications and shorter recovery time.
Conclusions: Laparoscopic hysterectomy (LAVH/ TLH) has a short learning curve and it's a feasible and beneficial surgical modality for treating benign uterine pathology even in a zonal hospital setting (low resource setting).

Keywords: Lap Assisted vaginal hysterectomy, Learning curve, Total lap hysterectomy

INTRODUCTION

Hysterectomy (derived from Greek hystera meaning uterus and ectome, a cutting out of) is one of the most common surgeries performed by the gynaecologists across the globe.[1,2] The first recorded hysterectomy was performed by Charles Clay in Manchester, England in 1843 while Richardson performed the first total abdominal hysterectomy (TAH) in 1929 in United States, recommending the excision of cervix to avoid cervical stump carcinoma.[3] History of laparoscopic hysterectomy is dated back to 1984 when Kurt Semm in Germany performed the first laparoscopic assisted vaginal hysterectomy (LAVH). Harry Reich is credited to have revolutionized the world of gynaecological surgeries by performing the first total laparoscopic hysterectomy (TLH) in January 1988 in Pennsylvania.[4] However, abdominal hysterectomy remains the most common

surgical approach for hysterectomy despite the documented and visible advantages of minimally invasive surgical route.[5]

Approx 0.5 million hysterectomies are performed each year in the United States, and more than 80% are for treatment of benign uterine pathologies, such as leiomyoma, abnormal uterine bleeding, pelvic organ prolapse, and endometriosis.[5,6] Despite consensus statements by both the American Association of Gynecologic Laparoscopists (AAGL) and the American Congress of Obstetricians and Gynecologists (ACOG) stating that minimally invasive hysterectomy should be the standard of care, more than 50% of hysterectomies are still performed for benign uterine pathologies by abdominal route (TAH).[7,8]

Minimally invasive hysterectomies and vaginal hysterectomies are associated with reduced blood loss and hospital stay, lesser incidence of sepsis episode, faster return to routine activities resulting into a greater degree of patient compliance when compared with more traditional route of hysterectomy, the total abdominal hysterectomy (TAH). The vaginal hysterectomy is a natural orifice surgery which should be the first route of consideration. But in patients with a history of an adnexal mass, endometriosis, chronic pelvic pain, previous abdominal surgery, with a narrow pubic arch or poor vaginal descent, vaginal route may be difficult. Laparoscopic hysterectomy should be attempted only when vaginal hysterectomy is not possible in a particular patient. The relatively slow acquisition of expertise in laparoscopic hysterectomy may be attributed to inadequate exposure and training during residency or lack of equipments or requisite individual skill.[9-11]

Hysterectomies for benign indications include abdominal (TAH), vaginal (VH), laparoscopic-assisted vaginal (LAVH), total laparoscopic (TLH), laparoscopic supra cervical (LSH) and robotic-assisted (RH). Progressive introduction and training in newer minimally invasive surgical techniques (LAVH, TLH, LSH, and RH) have resulted in an overall reduction in the abdominal hysterectomy rate from 77 to 35.2%.[12]

Learning curve for laparoscopic hysterectomy is confirmed by the decrease in operating time accompanied by no change or decrease in complications. On the other hand, one should not disregard the fact that laparoscopy is not a complication-free surgery and achievement of the learning curve does not exclude complications. Studies have shown that gynaecological surgeons can perform LAVH/TLH securely during the learning curve.[13]

All the studies on learning curve of laparoscopic hysterectomy were conducted in tertiary care teaching/university hospitals as per literature search. In view of the above, we conducted this retrospective study to analyze the learning curve and clinical efficacy of the art of laparoscopic hysterectomy in a zonal hospital setting (low resource setting) by a single surgeon with basic training in laparoscopy during residency.

METHODS

This study was a retrospective analysis of the learning curve and clinical efficacy of the art of laparoscopic hysterectomy (LAVH/TLH) for benign uterine pathologies in a zonal hospital of setting (low resource setting in terms of equipment profile and presence of expert assistance) by a single surgeon after his post-graduation. 102 cases of laparoscopic hysterectomies were included in the study for duration of five years from Aug 2010 to Aug 2015. Written informed consents were taken from all the patients. The cases were carefully selected with non-descent uteri of various sizes ranging from bulky uterus to maximum of 16-18 weeks' size with haemoglobin >10.0 gm/dl. Patients were divided sequentially into two groups comprising the first 50 patients and next 52 patients.

TLH was performed later in group I with increasing experience of surgeon in LAVH and improvement in equipment profile. Uterine size of ≤12 weeks size was taken up for TLH. Age, co morbidities like HTN, DM, obesity, previous Laparotomy/post LSCS status, indications for laparoscopic hysterectomy, duration of surgery, blood loss, hospital stay, post-operative analgesia duration, surgical complications, need for blood transfusion were evaluated. Post-operative haemoglobin was not ordered routinely except in cases requiring blood transfusion.

All the cases were performed under general anaesthesia. Three ports were used for surgery with a 10mm primary port (supraumbilical) and two accessory ports (5mm). In one case, primary port was introduced at Palmer's point as there was a midline laparotomy scar with mesh repair for incisional hernia done through the same scar. Energy sources used were bipolar and monopolar electrocautery as well as harmonic scalpel. Preoperatively bowel preparations and prophylactic antibiotics were used and three doses of cephalosporins with metronidazole were administered subsequently. Direct entry technique was used for trocar entry and surgery was performed in lithotomy and head low position. Urinary bladder catheterization was done prior to trocar entry by Foley's urinary catheter. Marwah's uterine manipulator was used in all cases. The hysterectomy was begun by bipolar coagulation and cutting by harmonic, of round ligaments, tubes and utero-ovarian ligaments, after dissection of any adhesions to the uterus by harmonic. The dissection and hemostasis of the infundibulopelvic ligaments with bipolar coagulation was performed in cases of hysterectomy with bilateral salpingo oopherectomy. The uterovesical fold was dissected from the uterus with monopolar/harmonic scissors, and the bladder was advanced caudally by sharp dissection. Steps of the LAVH and TLH were the same up to the bladder dissection.

Further skeletonization of the uterine vessels and bipolar coagulation were performed bilaterally in TLH followed by a circumferential colpotomy on the rim of the Marwah's manipulator cup with monopolar scissors. Anterior and posterior colpotomy was performed in LAVH with monopolar hook/spatula. In LAVH uterine artery and bilateral uterosacrals were clamped, ligated (No.1 polyglactin) and cut vaginally. Uteri were delivered vaginally irrespective of sizes due to non-availability of electromechanical morcellator. Bigger uteri were delivered out vaginally by bisection. Vaults were sutured vaginally with running absorbable suture (No. 1 polyglactin) as facility for endosuturing was not available. After closure of the vaginal cuff, saline irrigation of the pelvic cavity was performed to identify any bleeder, and haemostasis by bipolar coagulation was performed when required.

After ensuring haemostasis, the port sites were closed with subcuticular absorbable sutures. Blood loss measurement was done by subtracting the volume of saline used for irrigation to the total fluid collected in the suction apparatus. Post-operative analgesia used for first 24 hours after surgery was 8 hourly Inj. Pentazocine 30 mg IM with Diclofenac rectal suppositories. After 24 hours, Diclofenac suppositories were only used.

We chose the incision time as starting point of surgery for calculating the duration of surgery.

RESULTS

Patients were similar in age and co morbidities in both the groups with maximum number of patients in the age group of 46-50 years, 42% in Group I and 44.2% in group II. Patients with previous Laparotomy status and obesity were similar in both the groups (Table 1, Table 2).

Table 1: Age wise distribution in the two groups.

Age (years)	Group I	%	Group II	%
35 - 40	10	20	09	17.3
41 - 45	12	24	13	25
46 - 50	21	42	23	44.2
>50	09	18	07	13.4
Total	50		52	

Indications for LAVH/TLH were mainly leiomyomata uteri (fibroid) with or without abnormal uterine bleeding, 50% in Group I and 46.15% in Group II. Adenomyosis and endometriosis contributed 14 % in Group I and 15.37% in Group II (Table 3). Out of 102 patients 21 patients underwent LAVH/TLH with bilateral salpingo-oopherectomy, 07 (14%) in Group I and 14 (26.92%) in Group II. Uteri were of various sizes in both the groups. Group I had majority of uteri up to 10 weeks' size (78%) and 22% were more than 10 weeks whereas Group II had majority of uteri with size more than 10 weeks (57.68%) and 42.32% up to 10 weeks' size.

Table 2: Co-morbidities.

	Group I	%	Group II	%
HTN	07	14	05	9.61
Type 2 DM	07	14	08	15.3
HTN with Type 2 DM	03	06	04	7.69
Previous laparotomy status/ post LSCS	05	10	12	23.0
Obesity (BMI >30)	07	14	09	17.3
Total	50		52	

Biggest uterus was 690 grams in a case of fibroid uterus (18 weeks size), (Table 4). As the experience of the surgeon increased with increased number of laparoscopic hysterectomies, the percentage of TLHs increased in Group II, 42.31% Vs 18% in Group I (Table 5).

Table 3: Indications of laparoscopic hysterectomy.

Indications	Group I	%	Group II	%
Fibroid uterus	12	24	10	19.23
Fibroid uterus with AUB	13	26	14	26.92
Dysfunctional uterine bleeding	10	20	11	21.15
Post-menopausal bleeding with endometrial hyperplasia	05	10	04	7.69
Postmenopausal bleeding with LSIL	03	06	03	5.76
Adenomyosis	04	08	05	9.61
Endometriosis	03	06	03	5.76
Total	50		52	

Table 4: Uterine size.

Uterine size	Group I	%	Group II	%
Bulky uterus	16	32	10	19.23
6-10 wk size	23	46	12	23.07
10-14 wk size	09	18	24	46.15
14-18 wk size	02	04	06	11.53
Total	50		52	

Surgical outcomes of laparoscopic hysterectomy (LAVH/ TLH) in terms of mean operative time of 135 mins (Group I) vs 93 mins (Group II), estimated blood loss of 255 ml (Group I) vs 140 ml (Group II), hospital stay 05 days (Group I) vs 03 days (Group II), duration of postoperative analgesia 07 days (Group I) vs 05 days (Group II) were noted (Table 6). Foleys catheter was removed in all the patients on the first post-operative morning except in a case where bladder injury was repaired and the catheter was kept for seven days.

Table 5: Types of laparoscopic hysterectomy in the two groups.

	Group I	%	Group II	%
LAVH	41	82	30	57.69
TLH	09	18	22	42.31

Table 6: Surgical outcomes.

Mean of outcomes	Group I	Group II
Operative time	135 mins	93 mins
Estimated blood loss	255 ml	140 ml
Hospital stay	05 days	03 days
Duration of post-operative analgesia	07 days	05 days

Bladder injury in the form of a rent occurred in one patient in Group I which was repaired after converting to laparotomy. In another case laparotomy was performed to achieve haemostasis. Four patients were transfused with two units of PRBC each in Group I and one patient in Group II who had blood loss ≥600 ml respectively.

One patient in group I had post-operative haemoperitoneum who underwent exploratory laparotomy for haemostasis and subsequent transfusion of two units of PRBC. There were no incidences of bowel, ureter, blood vessel injury, post-operative sepsis, port site infection and anaesthetic complications (Table 7). All the patients were reviewed after one month duration with HPE reports following discharge from the hospital.

Table 7: Surgical complications.

	Group I	Group II
Bladder injury	01 (2%)	Nil
Conversion to laparotomy	03 (6%)	Nil
Blood transfusion	04 (8%)	01 (1.92%)
Ureteric Injury	Nil	Nil
Post op Haemoperitoneum and Exploratory Laparotomy	01 (2%)	Nil
Sepsis	Nil	Nil
Port site infection	Nil	Nil

DISCUSSION

The concept of learning curve was first described in aircraft manufacturing where the amount of man hours required to produce a single unit decreased at a uniform rate as the production quantity was doubled.

A similar idea has been adopted in the surgical field that learning a practical skill becomes easier with time with initial difficulty followed by a rate of improvement and finally stabilization in performance. Reduction in operating time and perioperative complications are the two most significant factors quoted for the learning curve of any surgical procedure. Contributing factors in the learning curve are technical skill and motivation on the part of surgeon, difficulty level of selected case and experience of the team.[16]

Makinen et al in their study on learning curve of laparoscopic hysterectomy concluded that surgeons who had performed more than 30 cases of laparoscopic hysterectomy had a significantly lower rate of intra operative complications.[17] Altgassen et al concluded after analyzing LAVHs performed by 33 different surgeons that a learning experience of 30 LAVH cases was essential to reach a desirable level of outcome.[16] Vaisbuch et al chose a cut off of 30 cases in their retrospective study of laparoscopic hysterectomies to analyze the learning curve.[18]

There is no data in the medical literature regarding the learning curve for LAVH/TLH in a zonal hospital setting as most of the studies are quoted from tertiary care teaching hospitals/University hospital settings with better equipments and expert assistance profile. In our study, we defined the first 50 cases of LAVH/TLH in our series as the early cases (instead of first 30 cases which were taken as early cases in various studies) and the subsequent 52 cases as the late cases. We, therefore, intended to investigate whether the noticeable reduction in surgical time and perioperative outcomes between the groups would point toward a learning curve for the laparoscopic hysterectomy.

Our study showed a reduction in the operating time between the early and the late cases (135 mins in Group I vs 93 mins in Group II) as well as minimal perioperative complications in Group II as compared to Group I. This finding reflects the learning curve for LAVH/TLH in present study as defined by a reduction in the operating time and perioperative complications after performing 50 cases which was consistent with the studies on the learning curve for laparoscopic hysterectomy.[16-18]

In our study, conversion to laparotomy was 6% and mean hospital stay was 05 days in Group I. Group II had no case requiring conversion to laparotomy while mean hospital stay was 03 days.

Study in a Brisbane tertiary hospital of first 120 consecutive cases of TLH performed, found the surgical morbidities to be maximum in middle one third of the patients with mean hospital stay of 2.4±1.4 days and conversion to Laparotomy was 6.6%.[14] Laparoscopic hysterectomy is associated with reduced overall intra and post-operative complications, estimated blood loss and there are trends towards shorter hospital stay and reduced incidences of post-operative haematoma formation compared to TAH.[21] Gynaecologists perform LAVH more easily than TLH due their training in vaginal hysterectomy during residency. TLH requires more technical expertise and a longer learning period.[22] In our study also, TLH was attempted later in group I and group

II had more percentage of TLH as compared to group I (42.31% vs 18%) (Table 5).

LAVH and TLH are readily adopted among a group of surgeons inexperienced in laparoscopy, although LSH might be easier to learn. Inexperienced surgeons have a gradual learning curve than do their experienced counterparts who have a steeper learning curve. It has been proven that proficiency for single port access TLH was achieved after 40 cases which is definitely indicating towards a learning curve for the procedure after performing a certain number of cases.[15,20]

The incidence of ureteral and bladder injuries is 0% to 2% and corresponds well to that in the current study.[23,24] There were no incidence of bowel and ureteric injury in the present study. Study in Finland over a period of 10 years on learning curve of laparoscopic hysterectomy documented the complication rates in terms of ureteral injuries (0.34%), bladder injury (0.32%) and bowel injury (0.09%). There was a definite decrease in complication rates as surgical expertise increased.[25] Minimally invasive surgery has been replacing the open standard technique in several procedures across the various surgical disciplines.

Laparoscopic training labs were developed to overcome this barrier of learning curve and developing surgical expertise in this field to minimize laparotomies for benign pathologies. A short period of training can improve minimally invasive surgical skills but full training in residency or fellowship program is the best way of instilling and improving laparoscopic surgical skills.[19]

The limitation of the current study is that it only reflects the learning experience of a single surgeon at a zonal hospital setting (low resource setting). His experience may not be consistently demonstrable by surgeons at other institutions.

CONCLUSION

Laparoscopic hysterectomy (LAVH/ TLH) has a short learning curve and it's a feasible and beneficial surgical modality for treating benign uterine pathology with good operative outcomes even in a zonal hospital setting. An increase in experience of the operating surgeon positively predicted a successful outcome in laparoscopic hysterectomy.

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