A Novel Approach to Minimally Invasive Hysterectomy Without the Use of a Uterine Manipulator; Kamran’s TLH.

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Original Article

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Abstract

Background: Hysterectomy remains one of the most common major gynaecological procedure, with total laparoscopic hysterectomy (TLH) now the established as the technique of choice over conventional open approaches. This approach depends on the use of a uterine manipulator to facilitate uterine retraction and colpotomy. This study describes a novel approach in performing total laparoscopic hysterectomy without the use of uterine manipulator or vaginal tubes and reports the intra- and post-operative outcome of this technique.

Methods: A single centre retrospective analysis of patients who underwent TLH without uterine manipulator or vaginal tube “Kamran’s TLH” for benign conditions was performed from January 2017 to October 2019. Data collected included patients demographics, intraoperative finding and postoperative course.

Results: A total of eighty six hysterectomies were performed utilizing the Kamran's TLH (KTLH) approach. Mean age was 52.2 (±11) years old and BMI was 28.2(±7). TLH with bilateral salpingo-oophorectomy was performed in 63(73.3%) patients and TLH with preservation of ovaries in 23 (26.7%) patients. Mean operative time was 64.7(±27.9) minutes and estimated bloods loss was 46.2(±54.6) ml. No intraoperative complications were recorded and there was no conversion to open surgery. Only one patient required readmission and surgery for vaginal vault dehiscence during their postoperative course.

Conclusion: Uterine manipulator is a key component in performing laparoscopic hysterectomy. However, our approach demonstrated that TLH can be safely performed without the use of any uterine or vaginal manipulation.

Background

Hysterectomy remains the most common major gynaecological procedure. Since the introduction of minimally invasive techniques in hysterectomy, several modifications have been adapted including vaginal and abdominal approaches[1]. Total laparoscopic hysterectomy (TLH) has been established as the procedure of choice among many laparoscopic surgeons. When compared to abdominal hysterectomy, Laparoscopic approach provides a quicker recovery, a less blood loss, a shorter hospital stay and less rate of infections [2]. Various TLH approaches has been described for both begin and malignant gynaecological diseases. Almost all of those techniques are dependent on the use of uterine manipulator or vaginal tubes[3]. Also, uterine manipulators are reported to offer the easiest way to manoeuvre the uterus[4]. Although, there is extensive literature published regarding TLH, only few studies reported TLH without the use of uterine manipulator or vaginal tube[5, 6].

The aim of this study is to evaluate our technique in performing TLH without the use of uterine or vaginal manipulation. Also, to report our intra and postoperative experience and to compare the results with the data of standard TLH reported in literature.
Methods

This is a retrospective analysis of patients who underwent TLH, without a uterine or vaginal manipulator, utilizing our technique, conducted by the department of Gynaecology at the Beacon Hospital in Dublin, Ireland. This case series details 86 consecutive Kamran's TLHs from January 2017 till October 2019. The inclusion criteria for this study were benign conditions including dysfunctional uterine bleeding, fibroids and endometriosis (Table-1). Exclusion criteria were malignancy involving uterus, cervix or ovary and patients who were deemed unsuitable for laparoscopy.

All data was collected from a prospectively maintained database and included patient's demographics, indication for hysterectomy, intraoperative findings, post-operative recovery and complications. All procedures were performed in a methodical and identical fashion by the same surgeon (WK) upon an agreed standard. All patients received prophylactic antibiotics. Follow-up included was in form of clinic visit usually 4–6 weeks after surgery, unless complication occurred.

The Clavien-Dindo score[7] was utilized to grade postoperative complications.

Data collected were presented as means or proportions ± standard deviation. All Statistical analysis were performed using SPSS version 18.0.

Operative Procedure

Patients are placed in lithotomy position, the abdomen, vagina and perineum are prepped and draped. A urinary catheter is inserted and the vagina was loosely packed with a sterile glove containing a swap to preserve the intrabdominal pneumoperitoneum during colopotomy. The energy device used in all cases was THUNDERBEAT®. However, any energy device can be applied according to preference.

Pneumoperitoneum is obtained using Hassan technique, four ports are placed; 12-mm port through umbilical, 5-mm in left lower side of the abdomen, and two 5-mm in the middle and lower right side of the abdomen.

The abdominal cavity and organs are inspected, then Trendelenburg position is obtained to bring the bowel away from the pelvic. A systematic approach is followed to remove any adhesion in order to obtain the optimal view to start hysterectomy.

Traction on the broad ligament was applied near the uterine side using a grasper through the assistant port to bring the uterus towards the anterior abdominal wall in order to stretch the infundibulo-pelvic ligament (Fig. 1). The infundibulo-pelvic ligament is coagulated and transected, which can be achieved with or without opening the pelvic side wall and is based on surgeon preference. The same step is repeated on the other side.
If Salpingo-oophorectomy is planned, the ovarian ligament is coagulated and cut before dissecting the round ligament (Fig. 2). The latter is then dissected and peritonectomy is performed bilaterally until the bladder peritoneum is separated. The bladder is dissected away from the cervix uteri with the assistant applying traction of the bladder peritoneum toward the anterior abdominal wall (Fig. 3).

Uterine vessels are coagulated and divided on both sides in anatomical fashion. Traction on the remnant of round ligament attached to the uterus is applied bilaterally to antevert the uterus toward the anterior abdominal wall, which helps the surgeon to identify and dissect the uterosacral ligament. Further dissection of the latter helps to obtain the view of the demarcation between the vagina and the cervix (Fig. 4). A dip is visualized between the cervix and the vagina to prepare colpotomy. Colpotomy is performed close to cervix either anteriorly or posteriorly and is completed circumferentially before the specimen is extracted vaginally with the help of grasper. Finally the vagina is closed laparoscopically with 1-Vicryl suture and the bladder is checked by filling it with Normal saline and one ampoule of blue die.

The operative time was calculated from initial skin incision until wound closure.

Results

Kamran's TLH (KTLH) was performed on 86 patients during a period of 34 months. Average patients’ age was 52.2 (± 11) years old with a mean BMI (Kg/m²) of 28.2(± 7). Nearly 25% of patients had some sort of previous pelvic surgery including Pfannensteil Laparotomy. The most common indication for hysterectomy was dysfunctional uterine bleeding at 43% (37/86). 51 (59.3%) women were multiparous and 17 (19.8%) were nulliparous (Table-1). Of the 86 hysterectomies, 63 (73.3%) procedures were KTLH with Bilateral salpingio-oophorectomy and 23 (26.7%) were KTLH and salpingectomy with preservation of ovaries. The overall mean operative time, from incision to closure of skin, was 64.7 (± 28) min, with overall estimated blood loos (EBL) of 46.2 (± 54.6) ml and total Length of stay (LOS) of 3.3 (± 1) days. 25 cases required mild (7-8.1%) to complex/extensive (12-13.9%) adhesiolysis (Table-2).

Only 5 (5.8%) patients required insertion of drains which was subsequently removed on postoperative day two. While urinary catheter was kept for average of 1.4(± 0.6) days, bowel motion occurred after 2.2 (± 0.75) days on average. Post-operative pain was calculated using visual analogy score (VAS) with 2.4(± 1.7), 3.7(± 2.1) and 1.4(± 1.3) on day 0, 1 and 3 postoperatively. The average days of analgesic requirement was 1.35(± 0.55) days. Table-2 summaries intraoperative and postoperative data.

The most common histopathological finding were fibroid uterus (44/86-51.2%) follow by Adenomyosis (25.6%) and Endometriosis (16.3%). Post-operative complications were classified according to Dindo-Clavien score as demonstrated (table-4). There was no intraoperative complication nor conversion to open surgery recorded in all included cases. Only one patient required readmission due to vaginal dehiscence which required repair under general anaesthesia. Other complications included; extra antibiotics usage during admission (6), vaginal granulomas (2), Vaginal vault infection (3), self-resolving...
pelvic collection (1), UTI (2). Only 1 (1.1%) women required post-operative bloods transfusion who was preoperatively anaemic.
Table 1
indications and characteristics of patients (n=86)

| Indications                        | Number (%) (SD) | ASA | ASA (SD) |
|------------------------------------|-----------------|-----|----------|
| Dysfunctional bleeding             | 37 (43%)        | 1   | 47 (54.7%) |
| Pelvic pain                        | 14 (16.3%)      | 2   | 37 (43%)  |
| Dysmenorrhea                       | 2 (2.3%)        | 3   | 2 (2.3%)  |
| Pelvic mass                        | 8 (9.3%)        | 4   | 0        |
| Protective surgery                 | 9 (10.5%)       |     |          |
| Atypical hyperplasia               | 12 (14%)        |     |          |
| CIN1 (+mild hyperplasia)           | 4 (4.6%)        |     |          |
| Known Fibroids                     | 20 (23.2%)      |     |          |
| **Total**                          | **86**          |     |          |
| **Surgical history**               |                 |     |          |
| Pelvic Surgery                     |                 |     |          |
| Vaginal                            |                 |     |          |
| Paramedian incision                |                 |     |          |
| Pfannenstiel                       |                 |     |          |
| Midline laparotomy                 |                 |     |          |
| Laparoscopy/ies                    |                 |     |          |
| **Medical history**                |                 |     |          |
| Hypothyroid                        |                 |     |          |
| HPN                                |                 |     |          |
| DM                                 |                 |     |          |
| Anaemia                            |                 |     |          |
| Breast cancer                      |                 |     |          |
| Smoker                             |                 |     |          |
| Asthma                             |                 |     |          |
| Anticoagulant/ Antiplatelet        |                 |     |          |

| Age                                | 52.2 (+11)       |     |          |
| BMI                                | 28.2 (+7)        |     | 9 (10.5%) |
| Pre-menopause                      | 53 (61.6%)       |     | 16 (18.6%)|
| Post-menopause                     | 33 (38.4%)       |     | 1 (1.2%)  |
| Nullipara                          | 17 (19.8%)       |     | 6 (7%)    |
| One para                           | 18 (20.9%)       |     | 14 (16.3%)|
| Multipara                          | 51 (59.3%)       |     | 9 (10.5%) |
| Smoker                             |                 |     | 2 (2.3%)  |
| Asthma                             |                 |     | 11 (12.8%)|
| Anticoagulant/ Antiplatelet        |                 |     | 7 (8.1%)  |
Values are given as mean ± SD (range) or number (percentage) unless stated otherwise. Abbreviation: BMI body mass index (calculated as weight in kilograms by the square of height in meters)

Table 2
operative And postoperative data

| Type of surgery          | N (%)/(SD) | Postoperative Data                  | N (%)/(SD) |
|--------------------------|------------|-------------------------------------|------------|
| TLH BSO                  | 63 (73.3%) | HG drop (g/L)                       | 1.2 (+.8)  |
| TLH BS                   | 23 (26.7%) | Average (days)                      |            |
| Total                    | 86         | Removal of urinary catheter         | 1.4 (+.6)  |
| Operative data           |            | Bowel motion (Days)                 | 2.2 (+.75) |
| Unilateral Ureterolysis  | 3 (3.5%)   | Mean LOS (days)                     | 3.3 (+1)   |
| Bilateral Ureterolysis   | 18 (20.9%) | VAS (mean)                          |            |
| Adhesiolysis             | 25 (29%)   | POD 0                               | 2.4 (+1.7) |
| Mild                     | 7 (8.1%)   | POD 1                               | 3.7 (+2.1) |
| Moderate                 | 6 (6.9%)   | POD 3                               | 1.4 (+1.3) |
| Extensive/Complex        | 12 (13.9%) | Mean days of analgesic required     | 1.35 (+0.55) |
| Operative time (mins)    | 64.7 (+27.9) |                                   |            |
| Estimated Bloods Loss (ml)| 46.2 (-54.6) |                               |            |
| Drain (n)                | 5 (5.8%)   |                                     |            |
| Mean (days)              | 2 (+0)     |                                     |            |
Values are given as mean ± SD (range) or number (percentage) unless stated otherwise. Abbreviation: LOS; length of stay, VAS; visual analogy score.
### Table 3

#### Postoperative complications

| Dindo-Clavien Score | Description                                                                 | N=86 | N(%)  |
|---------------------|------------------------------------------------------------------------------|------|-------|
| IIIB                | Issues requiring intervention under general anaesthesia                      |      |       |
|                     | Vaginal Dehiscence                                                          | 1    | (1.2%)|
| Total               |                                                                              | 1    | (1.2%)|
| IIIA                | Issues requiring intervention not under general anaesthesia.                 |      |       |
|                     | Vaginal Granuloma                                                            | 2    | (2.3%)|
| Total               |                                                                              | 2    | (2.3%)|
| II                  | Issues requiring pharmacological treatment with drugs other than those allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included. |      |       |
|                     | Vaginal infection                                                            | 3    |       |
|                     | Pelvic Collection                                                            | 1    |       |
|                     | Extra-Antibiotics                                                            | 6    |       |
|                     | Blood Transfusion                                                            | 1    |       |
|                     | Urinary Tract Infection                                                     | 2    |       |
| Total               |                                                                              | 13   | (15.1%)|
| I                   | Any deviation from the normal postoperative course not requiring therapy (allowed therapeutic regimens are drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy, wound infections opened at the bedside). |      |       |
| Total               |                                                                              | 16   | (18.6%)|

### Discussion
Hysterectomy is one of the most commonly performed major gynaecological procedures. Since the introduction of total laparoscopic hysterectomy in 1993\cite{8}, many surgeons have adopted various modifications and tools that could help in making the surgery safer and more accessible. One of the tools is the uterine manipulator which is widely used in various gynaecological procedures. It is regarded as a key instrument in total laparoscopic hysterectomy as it thought to provide better visualization of surgical field, delineation of colpotomy and reducing risk of ureteric injury\cite{4}.

Despite technological advances and the contemporary implementation of laparoscopic hysterectomy as the standard of care, only few studies reported TLH without the use of uterine manipulator or vaginal tubes in the setting of benign conditions. One case study reported the efficacy and the safety in performing TLH without the use of manipulator or tube in two large uteruses, weighting 5700 g and 3670 g. This study highlighted the limitation of the manipulator in case of vaginal stenosis and restricted anatomy\cite{6}. A retrospective study compared the outcomes of TLH without manipulator between two groups according to uterus size, stated that laparoscopic hysterectomy without uterine manipulator can be more appropriate in cases of vaginal stenosis\cite{9}. However, both of those studies did not disclose details pertaining to the surgical technique.

A study on 67 laparoscopic hysterectomies by Kavallaris et al confirmed that TLH can be safely done without uterine manipulation. This study supported the hypothesis that total laparoscopic hysterectomy without manipulator (TLHwM) was appropriate and feasible in patients with vaginal stenosis and small cervix, where the application of instruments are inaccessible. Furthermore this technique avoids the potential of short vagina syndrome by incising it close to cervix, under direct visualization\cite{5}. However, a limitation of the technique reported by Kavallaris et was the requirement of digital vaginal manipulation at the stage of coloptomy. In contrast to this, our approach (KTLH) didn't apply any kind of vaginal instrumentation or manipulation except when the specimen was extracted.

It is reported in the literature that uterine manipulator are may help to reduce lower urinary tract injury by lateralization of uterus allowing perpendicular dissection of uterine arteries\cite{10},\cite{11}. According to a literature review on laparoscopic hysterectomy, the overall incidence of urinary tract injury was 0.73\%, while ureteral injuries ranged from 0.02–0.4\% and bladder injuries were 0.05–0.66\%\cite{12}. However, our present data demonstrated neither ureteric nor bladder injuries in all 86 women.

In the present study the mean operative (64.7 minutes) time was shorter then reported in standard TLH (99.3\cite{13} and 126 minutes\cite{14}). The shorter operative time can be explained by the elimination of the time needed to apply uterine or vaginal manipulation.

We also observed less intraoperative blood loss comparing with TLH with uterine manipulator. Jugent et al\cite{15} and Candiani et al \cite{13} reported bloods loos of 98 ml and 83 ml respectively, which were almost twice as much as our bloods loss (46.2 ± 54.6 ml). Also, our reported decrease haemoglobin concentration (1.2 ± 0.8 g/L) was comparable to that reported by Ribiero et al\cite{16}.
On Analysing postoperative recovery, our reported pain and the requirement for analgesia were comparable to previous studies on TLH with the use of uterine manipulator[17],[18],[13]. Additionally, our length of stay (3.3 ± 0.97 days) was comparable to that reported in literature[2],[19],[20]. Under normal conditions, our patients could be discharged on post-operative day 1 or 2. This is keeping with a publication by Candiani et al advocating the 33% of patient undergoing TLH could be discharged on day 2 after surgery. Moreover, hospitalization time doesn’t entirely represent postoperative recovery, as it is often driven by economic aspects, hospital setting, patient’s tolerance and local policies[2].

In the present study, there were no intraoperative complications. Intraoperative complications in TLH include bladder injury (1.2-2%), ureteral injury (0.6–0.9%), bowel injury (0.2–0.8%) and other laparoscopic related injuries[21]. In many studies on total laparoscopic hysterectomy, intraoperative complications weren’t grouped and these are reported as overall postoperative complications[2]. Moreover, none of the 86 TLH in our current study required conversion to open surgery. In previous reports, the rate of conversion was up to 5.8% [22],[23],[24]. This is mostly related to technical difficulties, extensive adhesion, uncontrolled bleeding and the experience of the surgeon[21].

In our series, postoperative complications were categorized according to The Clavien-Dindo score. There was only 1 (1.2%) grade IIIB complication, a patient with a vaginal wall dehiscence as a consequence of premature sexual intercourse. It required a vaginal-approached repair under general anaesthesia. This was the only complication requiring reintervention or admission. A review on 47 laparoscopic hysterectomy studies concluded that the incidence of vaginal dehiscence was up to 0.64%[25]. Grade IIIA complications occurred in 2 (2.3%) patients in form of a vaginal granuloma which was excised in the outpatient clinic.

The rest of complications were grade II (13/86 15.1%): 6 patients required extra-antibiotics coverage, 3 patients developed vaginal vault infection, one pelvic collection which was spontaneously resorbed, one patient required bloods transfusion post operatively for preoperative anaemia and 2 urinary tract infections. Overall, total number of all grades of complications were 16/86 (18.6%). Our reported complication rate is favourable when compared to Mereu et al. who retrospectively reviewed 361 TLH with similar overall complications rate (53/361 – 14.6%).

Although uterine manipulator has several reported benefits, Total laparoscopic hysterectomy without uterine manipulator (KTLH) is a systematic approach to perform TLH without uterine or vaginal manipulation. Our technique illustrated reduced operative time, reduced cost of procedural costs, obviates the need for an assistant for the manipulation and less intraoperative complications. KTLH is also beneficial in situations when application of uterine manipulator is inaccessible such as those with vaginal stenosis or huge uterus.

**Conclusion**

Our experience in total laparoscopic hysterectomy demonstrated a safe, feasible and easily reproducible technique without the use of any uterine or vaginal manipulation that can be adopted universally by
trainee and already practicing surgeon as well.

Declarations

Ethical Approval

Ethical approval was granted from the local auditing committee.

Consent for publication

Consent for supplementary figures was obtained.

Availability of data and materials

The data that support the findings of this study are available from Beacon hospital database but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of Beacon Hospital.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. No financial disclosures. The authors report no conflict of interests.

Authors contributions

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a- Data collection, data revalidation, writing manuscript, Corresponding Author.

b- revising of manuscript.

c- supervision and revision of manuscript/ technique developer.

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References
1. Elkington NM, Chou D (2006) A review of total laparoscopic hysterectomy: role, techniques and complications. Curr Opin Obstet Gynecol 18(4):380–384

2. Mereu L et al (2018) Total laparoscopic hysterectomy for benign disease: outcomes and literature analysis. Gynecol Surg 15(1):19

3. Popa A, Copaescu C, Horhoianu V (2019) Laparoscopic total hysterectomy still not routinely chosen Operative description and available instruments. Journal of medicine life 12(3):301–307

4. van den Haak L et al (2015) Efficacy and safety of uterine manipulators in laparoscopic surgery: a review. Arch Gynecol Obstet 292(5):1003–1011

5. Kavallaris A et al (2011) Total laparoscopic hysterectomy without uterine manipulator: description of a new technique and its outcome. Arch Gynecol Obstet 283(5):1053–1057

6. Macciò A et al (2018) Feasibility and safety of total laparoscopic hysterectomy for huge uteri without the use of uterine manipulator: description of emblematic cases. Gynecol Surg 15(1):6–6

7. Clavien PA, Sanabria JR, Strasberg SM (1992) Proposed classification of complications of surgery with examples of utility in cholecystectomy. Surgery 111(5):518–526

8. Reich H, Laparoscopic Hysterectomy, Practical Manual of Operative Laparoscopy and Hysteroscopy, R. Azziz and A.A. Murphy, Editors. 1997, Springer New York: New York, NY. pp 194–208

9. Mebes I, Diedrich K, Banz-Jansen C (2012) Total laparoscopic hysterectomy without uterine manipulator at big uterus weight (> 280 g). Arch Gynecol Obstet 286(1):131–134

10. Hohl MK, Hauser N (2010) Safe total intrafascial laparoscopic (TAIL™) hysterectomy: a prospective cohort study. Gynecol Surg 7(3):231–239

11. Mueller A et al (2012) The Hohl instrument for optimizing total laparoscopic hysterectomy: results of more than 500 procedures in a university training center. Arch Gynecol Obstet 285(1):123–127

12. Adelman MR, Bardsley TR, Sharp HT (2014) Urinary Tract Injuries in Laparoscopic Hysterectomy: A Systematic Review. Journal of Minimally Invasive Gynecology 21(4):558–566

13. Candiani M et al (2009) Laparoscopic vs vaginal hysterectomy for benign pathology. Am J Obstet Gynecol 200(4):368.e1–368.e7

14. Allam IS et al (2015) Total laparoscopic hysterectomy, vaginal hysterectomy and total abdominal hysterectomy using electrosurgical bipolar vessel sealing technique: a randomized controlled trial. Arch Gynecol Obstet 291(6):1341–1345

15. Jugnet N et al., Comparing vaginal and coelioscopic total or subtotal hysterectomies: prospective multicentre study including 82 patients. 2001. 10(5-6): p. 315–321

16. Ribeiro SC et al (2003) A randomized study of total abdominal, vaginal and laparoscopic hysterectomy. International Journal of Gynecology Obstetrics 83(1):37–43

17. Eggemann H et al (2018) Laparoscopic-assisted vaginal hysterectomy versus vaginal hysterectomy for benign uterine diseases: a prospective, randomized, multicenter, double-blind trial (LAVA). Arch Gynecol Obstet 297(2):479–485
18. Garry R et al (2004) EVALUATE hysterectomy trial: a multicentre randomised trial comparing abdominal, vaginal and laparoscopic methods of hysterectomy. Health Technol Assess 8(26):1–154
19. Wallwiener M et al (2013) Laparoscopic supracervical hysterectomy (LSH) versus total laparoscopic hysterectomy (TLH): an implementation study in 1,952 patients with an analysis of risk factors for conversion to laparotomy and complications, and of procedure-specific re-operations. Arch Gynecol Obstet 288(6):1329–1339
20. Morelli M et al (2007) [Total laparoscopic hysterectomy versus vaginal hysterectomy: a prospective randomized trial]. Minerva Ginecol 59(2):99–105
21. Moria A, Tulandi T (2011) A critical review of laparoscopic total hysterectomy versus laparoscopic supracervical hysterectomy. Gynecol Surg 8(1):7–12
22. Mousa A, Zarei A, Tulandi T (2009) Changing practice from laparoscopic supracervical hysterectomy to total hysterectomy. J Obstet Gynaecol Can 31(6):521–525
23. Harmanli OH et al (2009) A comparison of short-term outcomes between laparoscopic supracervical and total hysterectomy. Am J Obstet Gynecol 201(5):536.e1–536.e7
24. van Evert JS et al (2010) Laparoscopic subtotal hysterectomy versus laparoscopic total hysterectomy: a decade of experience. Gynecol Surg 7(1):9–12
25. Uccella S et al (2011) Vaginal cuff closure after minimally invasive hysterectomy: our experience and systematic review of the literature. Am J Obstet Gynecol 205(2):119.e1–119.e12

Figures
Figure 1

Stretching and transection of the Infundibulo-pelvic ligament

Figure 2

Coagulation and transection of the ovarian ligament
Figure 3

Reflection of the bladder away from the cervix uteri
Figure 4

Dissection of the uterosacral ligament to obtain the view of the demarcation between the vagina and the cervix to prepare the colpotomy