

Ten steps towards a safe and feasible total laparoscopic hysterectomy

Diez pasos para una histerectomía total por laparoscopia segura y reproducible

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Abstract

Objective: To contribute to the training of specialists by describing in a systematic and detailed way the ten steps to perform a safe and feasible Total Laparoscopic Hysterectomy (HTL). **Method:** The detailed description of the steps of the HTL intends that this procedure can be safely and effectively reproduced. **Results:** By clearly knowing the steps of HTL, it is possible to favor minimally invasive routes so that patients benefit from its multiple proven benefits. **Conclusions:** The benefits of minimally invasive routes for performing a hysterectomy have already been demonstrated in the literature. It is particularly important that specialists are familiar with these techniques and that groups standardize the procedure so that more patients can safely undergo and benefit from the laparoscopic approach.

Keywords: Hysterectomy. Laparoscopy. Surgical procedures. Safety.

Resumen

Objetivo: Contribuir a la formación de los especialistas describiendo de manera sistemática y pormenorizada los diez pasos para realizar una histerectomía total por laparoscopia (HTL) segura y reproducible. **Método:** La descripción detallada de los pasos de la HTL pretende que este procedimiento pueda ser reproducido de manera segura y efectiva. **Resultados:** Al conocer claramente los pasos de la HTL es posible favorecer las rutas de mínima invasión para que las pacientes se beneficien de sus múltiples beneficios demostrados. **Conclusiones:** Los beneficios de las rutas mínimamente invasivas para la realización de una histerectomía ya han sido demostrados en la literatura. Es muy importante que los especialistas estén familiarizados con estas técnicas y que los grupos estandaricen el procedimiento para que más pacientes puedan ser intervenidas de manera segura y se beneficien de la vía laparoscópica.

Palabras clave: Histerectomía. Laparoscopia. Procedimientos quirúrgicos. Seguridad.

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Introduction

Hysterectomies are one of the most commonly performed gynecology procedures. The risk of undergoing a hysterectomy in life 20-45%, depending on the social, economic, cultural, and technological characteristics of each community¹⁻⁶.

The route for benign hysterectomies has been changing. The first planned vaginal hysterectomy was performed by Langenbeck in 1813, but the first series of vaginal hysterectomy cases was published by Senn in 1895 and its mortality rate was 75%⁷⁻⁹.

The first abdominal hysterectomy in which the patient survived was performed in 1853 by Burnham. The patient recovered and Burnham performed 15 more hysterectomies during the following 13 years. However, only three of those patients survived and the others died of sepsis or hemorrhage. Later on, Keith implemented several aseptic techniques, and in 1910, the mortality rate for this procedure decreased to 2.5%, and in this way, the abdominal procedure became the most commonly used up until today^{8,10,11}.

Gynecologists were the pioneers in laparoscopic surgery, and as technology advances, so did surgical techniques. Harry Reich performed the first total laparoscopic hysterectomy (TLH) in 1989 and, since then, an increasing number of procedures are performed with this technique^{8,11,12}.

After the first robotic cholecystectomy performed in 1997, this development reached all other specialties, and in April 2005 the Food and Drug Administration authorized the use of the Da Vinci robotic system (Intuitive Surgical, Inc., Sunnyvale, CA, USA) in gynecologic surgery¹³⁻¹⁶.

Despite the proven advantages of the minimally invasive hysterectomy techniques the abdominal approach is the most widely used, especially in countries with medium to low income. The laparoscopic approach have been growing steadily in the last few years, and in some countries it is the preferred approach^{13,17-20}.

There are several obstacles for the generalization of minimally invasive techniques, such as difficulty accessing training, learning curves, low resident exposure to these techniques, health system barriers, lack of support from colleagues who do not perform laparoscopic surgery, and the belief that minimally invasive surgery will have insufficient reimbursement^{15,21}.

The objective of this article is to contribute to the ongoing training of specialists by thoroughly

describing the ten steps to perform a safe and feasible TLH.

The following steps describe the standard method to perform a TLH in the Unidad de Laparoscopia Ginecológica Avanzada y Dolor Pélvico, ALGIA, Clínica Comfamiliar in Pereira, Colombia. ALGIA is a training center for advanced minimally invasive and pelvic pain techniques. Our center performed the first TLH in the region over 20 years ago, and since then it has become a reference center for highly complex cases and with high surgical volume. We hope that readers can adopt this surgical approach in order to apply it to their care practice, for their own benefit and the benefit of their patients^{13,17,21}.

The objective of this article is to contribute to the training of specialists by systematically and thoroughly describing the ten steps to perform a safe and feasible TLH.

Method

We will thoroughly describe the ten steps used by this group in order to make the TLH a safe and feasible surgical procedure. This group performs an average of 250 laparoscopic hysterectomies per year. Our rate of minor complications is 3.48%, and 2.5% for major complications. Our conversion rate to laparotomy is 0.23%. There have been no mortality cases associated with TLH.

Step 1: preparing the procedure and positioning the patient

All patients are seen in the presurgical consultation by an ALGIA member. It is important for patients to be properly informed of their condition, the indication for their hysterectomy, the different therapeutic options, as well as the risks and benefits of this procedure. During the outpatient visit patients receive general information regarding the procedure and the informed consents that list, in a detailed manner, the generalities of the procedure and the risks of complications, both for the laparoscopic technique and the hysterectomy.

Patients enter the presurgical preparation room of the clinic approximately 60 minutes before the scheduled surgery. Here, it is confirmed that the patient is properly informed of the procedure, that the preanesthetic indications have been met, and that the informed consents were read and processed adequately.



Figure 1. Patient position.

In general, presurgical intestinal preparation is not indicated. The patient received 2 grams of intravenous cefazolin as a presurgical antibiotic prophylaxis. Then, the patient is taken to the operating room, where one of the surgeons has verifies the correct position, arrangement, and operation of the equipment, including the electrosurgical generator, the camera, the lighting source, and the pneumatic insufflator. The patient is placed in the dorsal lithotomy position before administering general anesthesia in order to ensure that there are no pressure points during surgery. The upper limbs are placed parallel to each other and touching the body. No popliteal pressure or extreme flexion of the wrists and waist or hip must be ensured, and shoulder pads are placed in order to prevent the body from sliding down the Trendelenburg (Fig. 1).

Ergonomics must be ensure during the procedure. Therefore, the operating table must be placed in such a way that allows for adequate mobility of the surgeon, and the monitors must be in front of the surgeon and the assistant. The entire surgical team, including surgeons, assistants, anesthetists, surgical instrument assistant, and nursing staff, must be familiar with the procedure to be performed and the equipment used. Then, the checklists are verified. In addition to the checklist proposed by the World Health Organization, we use a specific laparoscopy checklist that verifies equipment and instrument condition, and that the patient is placed correctly.

Step 2: Foley catheter and uterine manipulator

A physical exam is performed under general anesthesia in order to confirm previous findings and the procedure. Then, the surgical scrub of the abdomen and vaginal/perineal area is performed. A 20 G Foley catheter is inserted with 5 ml in the balloon before

inserting the uterine manipulator to help placing the latter. Afterwards, the uterine manipulator is positioned. We use a VCare® type uterine manipulator (ConMed Endosurgery, Utica, NY, USA: <https://www.conmed.com/en/medical-specialties/laparoscopic-robotic-and-open-surgery/gyn-and-gyn-oncology/instruments/uterine-manipulation/vcare-plus-and-vcare-dx>), but other models, such as the RUMI® (Cooper Surgical, Trumbull, CT, USA: <https://www.coopersurgical.com/medical-devices/detail/rumi-ii-uterine-manipulator-handle>) or the Clermont-Ferrand® (Karl Storz, Tuttlingen, Germany: https://www.karlstorz.com/cps/rde/xbcr/karlstorz_assets/ASSETS/2975530.pdf) are equally useful. The selection of the manipulator depends on the familiarity of the surgical group with each type, size of the uterine neck, the length and diameter of the vagina, uterine volume and menopause status. Occasionally, we see patients who have never engaged in sexual intercourse, have been treated with testosterone for prolonged periods (for gender reassignment, for instance), or have a marked postmenopausal atrophy, and, in these cases, a uterine manipulator cannot be used. The use of lidocaine as a lubricant can facilitate the placement of the uterine manipulator. Sometimes it is necessary to perform an episiotomy in order to insert the manipulator.

It is very important to use a vaginal cup of the right size that allows the proper delineation of the vaginal fornices. Very large cups can increase the risk of ureteral injury, and very small cups do not allow to delineate the vagina and properly separate the bladder.

Step 3: abdominal entry and placement of the main and accessory ports

No entry technique is safer than another. The surgeon must use the technique they are more familiar with. Risks decrease when a surgeon has performed more than 100 laparoscopic entries a year with a specific technique. Our group uses the direct entry technique^{22,23}.

Entry is made with the patient in the neutral position, before placing her in the Trendelenburg. We use a 10 mm main umbilical trochar and a 0° lens. After inserting the trochar, it is confirmed that the instrument is intraperitoneally placed and injuries related to entry are ruled out. Afterwards, the Trendelenburg is placed. We use a 30-degree-angle or lower, and generally, we avoid extreme Trendelenburg due to its



Figure 2. Trochar Position.

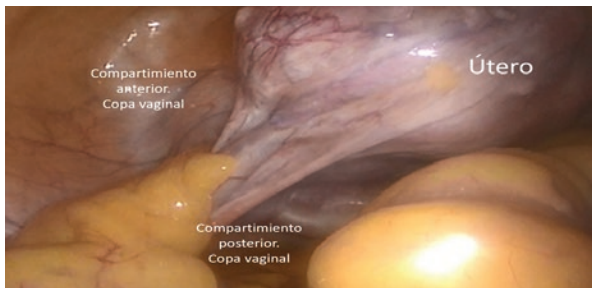


Figure 3. Position of the uterine manipulator and the anterior and posterior vaginal cup.

potential deleteral respiratory, cardiovascular, musculoskeletal effects, and the consequences for the central nervous system and optic nerve, and due to postoperative pain. The creation of an initial pneumoperitoneum at a pressure of 15 mmHg is recommended²⁴⁻²⁷.

Three 5 mm accessory ports are inserted in the right iliac fossa, the left iliac fossa, and the left flank (Jain point). We use an arrangement that allows for laparoscopic suture in the vertical are, such as described by Koh. The ports (main and accessory) must be 7 cm from each other to prevent intraperitoneal instrument impact and to facilitate ergonomics²⁸⁻³⁰ (Fig. 2).

It is possible that trochar entry sites must vary according to the intrapelvic pathology and the size of the uterus, but the distribution of the 10 mm main port and three 5 mm accessory ports is maintained generally. It must always be considered that during the superficial and deep vasculature of the abdominal wall, in particular the lower epigastric arteries, in order to prevent injury during the entry of accessory trochars³¹⁻³³.

As soon as the accessory ports have been inserted, the intraabdominal pressure is decreased to values between 8 and 12 mmHg in order to decrease the eventual negative effects of intraabdominal pressures

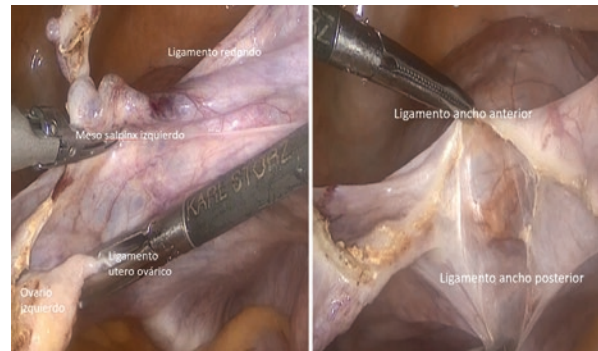


Figure 4. Upper pedicle.

of 15 mmHg or higher on the cardiopulmonar physiology and postoperative pain. Proper visualization is not compromised with low pressure^{34,35}.

As soon as the umbilical port is positioned, the pneumoperitoneum has been created, the Trendelenburg has been given, and the accessory ports have been inserted, the pelvic cavity is examined and the intraoperative findings are identified. The proper position of the uterine manipulator, mobility of the uterus, and access to uterine pedicles and to the anterior and posterior vaginal cup is confirmed (Fig. 3).

Step 4: upper pedicles

A bilateral salpingectomy is performed in all patients, and we do not perform a bilateral salpingectomy-oophorectomy in patients under 55 years, except for special cases³⁶.

The mesosalpinx is coagulated and cut bilaterally, being particularly careful with the blood vessel that run between the ovary and the round ligament, in order to avoid bleeding. Then, the uterine-ovarian ligaments are accessed, coagulated and cut bilaterally, and finally, the same is done with both round ligaments. Opening the round ligament provides access to the wide ligaments, which are widely separated by traction and countertraction. In patients where a unilateral or bilateral salpingectomy-oophorectomy is performed, the pelvic infundibulum ligaments are coagulated and sectioned, and then the same is done with the round ligaments, in order to access, in the same way, the wide ligaments (Fig. 4).

Step 5: mobilizing the bladder

The uterine manipulator must be pushed firmly so that the vaginal cup delineates the anterior fornix. The goal is

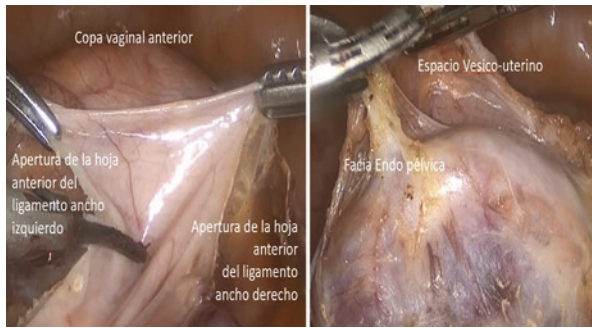


Figure 5. Vesico-cervicovaginal space.

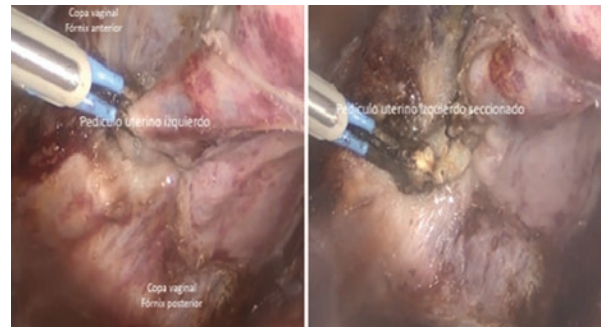


Figure 6. Lower pedicle.

to join the anterolateral opening of the wide ligament blades at the middle line. The proper plane must be used in order to separate the peritoneum with a mild manipulation. The endopelvic fascia is identified and the bladder is moved towards the caudal end. The areolar tissue must be kept loose. If fatty tissue is found or if there is bleeding, it could be because the dissection is too close to the bladder and the planes must be reconsidered. In patients where the bladder has ascended (history of C-section, for instance), the procedure must be kept relative high on the uterus during the dissection (Fig. 5).

Step 6: securing uterine pedicles

After moving the bladder towards the caudal end, the uterine pedicles are dessicated and exposed. It is important to remember that the uterine pedicles have uterine arteries that run between the superficial anterior uterine vessels and the deep posterior uterine vessels. The uterine manipulator must be pushed in order to move away the uterine vessels from the ureter and delineate the anterior and posterior vaginal fornices. In order to avoid the rate of ureteral injury in this step, we must always stay below the vaginal cup. First, the pedicle is coagulated with bipolar energy (30-35 W). Once bubbles stop forming, the vessels are ready to be cut. Then, they are cut with cold scissors, ultrasonic energy or advance bipolar energy instruments. The vascular pedicle must fall to the side and caudal end, providing proper avascular access to the vaginal cup (Fig. 6).

Step 7: separating the uterus and the uterine neck from the vaginal vault

The vaginal fornices are identified while the uterine manipulator is firmly pressed towards the Then, the

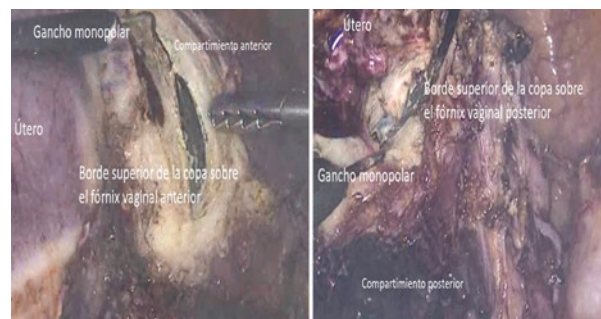


Figure 7. Opening of the vaginal vault.

anterior and posterior protruding vaginal cup must be seen and palpated. When the cup is properly identified, a circumferential cut is made using a fine point element and monopolar energy (pure cut, non-modulated energy) at 50 W. We use an L shaped monopolar cut electrode-hook (Karl Storz, Tuttlingen, Germany: https://www.karlstorz.com/cps/rde/xbcr/karlstorz_assets/ASSETS/3331472.pdf), but there are other types available on the market. Be careful not to cut below the cup and ensure that the incision follows a posterior to anterior pattern. Make sure to cut over the tissue that has been prepared in previous steps and not over tissue that has not been coagulated properly in order to avoid delays, loss of visibility and intraoperative bleeding (Fig. 7).

Step 8: removal of uterus

When the cut over the vaginal cup releases the surgical piece, be careful to not let it slide inside the cavity towards the head, and eventually lose it within the abdominal content. The uterus neck must be in the vaginal canal and be pulled with a forceps or a strong triple gripper. Generally, the uterus must be easily removed through the vagina, but in patients with a large



Figure 8. Closing of the vaginal vault.

uterus or a small or low elasticity vagina, this step can be challenging. A transvaginal morcellation can be considered, or in special circumstances, even the use of a laparoscopic electric morcellator. Sometimes, an episiotomy can aid in the extraction. In order to maintain intraabdominal pressure after removing the uterus, the vaginal canal can be occluded with wet compresses or with a glove with a couple of gauzes inside. The uterus can also be kept inside the vaginal canal as a plug.

Step 9: closing of the vaginal vault

Our group always closes the vaginal vault using the laparoscopic approach with a continuous suture in two planes. The first plane involves the anterior and posterior vaginal mucous membranes. It starts on the right side angle of the vaginal cuff and it continues towards the contralateral angle. The second plane includes the posterior peritoneum and the fascias of the anterior pericervical ring. The suture is tied where the first plane began to finish closing the vault. Generally, we use approximately 22 cm of absorbable polidioxanone 2-0 monofilament type sutures with a SH needle. We do not use barbed sutures, as several studies have shown that it does not have any advantages over the other type. Additionally, our center is a training facility, and two planes provide personnel in training with more exposure to the suture than only one plane^{37,38}.

A suspension is made from the vaginal vault to the uterosacral ligaments (McCall) at the time of the second plane in order to reduce the risk of apical prolapse³⁹ (Fig. 8).

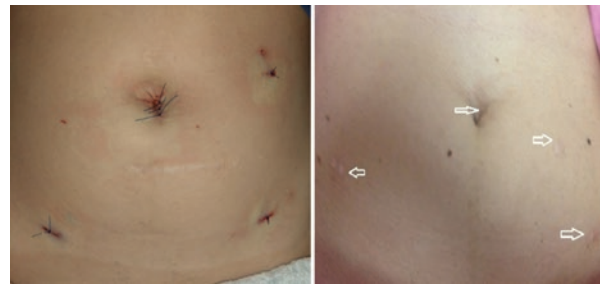


Figure 9. Skin suture.

Step 10: final evaluation of hemostasis and abdominopelvic cavity. The pneumoperitoneum is drained and the ports and skin are closed. Postoperative care

Finally, the hemostasis and the abdominopelvic cavity are carefully examined. Blood and detritus are washed and suctioned, and the procedure is completed. We leave 30 ml of bupivacaine without epinephrine at 0.125% in the peritoneal cavity, and the accessory trochars are removed. We actively empty the pneumoperitoneum while the anesthetist provides positive pressure (lung recruitment maneuvers), and the main trochar is removed. We administer local anesthesia to the four incisions and we suture the skin with a non-absorbable synthetic polypropylene 3-0 suture with a SC-24 needle, and the sutures will be removed within 7-10 days⁴⁰⁻⁴³ (Fig. 9).

Once the procedure and extubation are completed, the patient is moved to the recovery room. Minimizing nausea and vomiting is crucial after surgery, and emphasis is made on the early and adequate control of acute postoperative pain. If the patient evolves adequately within the first 3-4 hours, she is taken to a pre-discharge room, where the *fast-track* is applied, and she is discharged after tolerating oral intake, moving early and adequately, and has had spontaneous diuresis after removing the urinary catheter according to the enhanced recovery protocol after surgery (ERAS). Our average postoperative wait time after a TLH is 13 hours⁴⁴⁻⁴⁶.

The patient is discharged with strict postoperative recommendations that are given verbally and in writing both to the patient and her companion. A medical postsurgical analgesic formula with acetaminophen, 1g/6 h is taken orally for 5 days; in addition, a non-steroidal anti-inflammatory (diclofenac 75 mg/12 h is

given intramuscularly or naproxen 250 mg/8 h orally) for 3 days, and metronidazole, an intravaginal ovule (500 mg), every 12 hours for 5 days immediately after surgery. The patient will be given medical leave for 10-14 days.

The patient will see a nurse to remove suture and evaluation 7-10 after the procedure, and then will be seen for a formal postoperative follow up at ALGIA within 10-14 with the pathology results, and finally at 6 weeks.

Results

By becoming thoroughly familiar with the TLH steps it is possible to promote the minimally invasive route for patients to benefit from its multiple proven advantages.

Discussion

Despite their known and proven benefits, the minimally invasive approaches to a hysterectomy are still at a disadvantage compared to the laparotomy, especially in countries with low and medium income. Therefore, it is very important for surgical groups to become familiar and streamline minimally invasive surgical techniques seeking to increase the number of patients that can safely benefit from them.

Conclusions

The benefits of minimally invasive procedures for hysterectomies have been proven in the existing literature. It is very important for specialists to become familiar with these techniques, and for groups to standardize the procedure so more patients can be undergo a safe procedure by benefiting from laparoscopic means.

Ethical disclosures

Protection of People and Animals. The authors state that no experiments have been conducted in humans or animals for this research.

Data Confidentiality. The authors state that the protocols of their work center regarding the publication of patient data have been followed.

Right to privacy and informed consent. The authors have obtained informed consent from the patients and/or subjects mentioned in the article. This document is owned by the corresponding author.

Conflicts of interest

None of the authors have any conflicts of interest to declare in regard to this original research work.

References

- Cooper R, Hardy R, Kuh D. Timing of menarche, childbearing and hysterectomy risk. *Maturitas*. 2008;61:317-22.
- Jonsdottir GM, Jorgensen S, Cohen SL, Wright KN, Shah NT, Chavan N, et al. Increasing minimally invasive hysterectomy: effect on cost and complications. *Obstet Gynecol*. 2011;117:1142-9.
- Merrill RM. Prevalence corrected hysterectomy rates and probabilities in Utah. *Ann Epidemiol*. 2001;11:127-35.
- Vessey MP, Villard-Mackintosh L, McPherson K, Coulter A, Yeates D. The epidemiology of hysterectomy: findings in a large cohort study. *Br J Obstet Gynaecol*. 1992;99:402-7.
- Wilson LF, Mishra GD. Age at menarche, level of education, parity and the risk of hysterectomy: a systematic review and meta-analysis of population-based observational studies. *PLoS One*. 2016;11:e0151398.
- Stewart EA, Shuster LT, Rocca WA. Reassessing hysterectomy. *Minn Med*. 2012;95:36-9.
- Byrnes JN, Occhino JA. Hysterectomy for benign conditions of the uterus: total vaginal hysterectomy. *Obstet Gynecol Clin North Am*. 2016;43:441-62.
- Sutton C. Hysterectomy: a historical perspective. *Baillieres Clin Obstet Gynaecol*. 1997;11:1-22.
- Moen MD, Richter HE. Vaginal hysterectomy: past, present, and future. *Int Urogynecol J*. 2014;25:1161-5.
- Moen M. Hysterectomy for benign conditions of the uterus. *Obstet Gynecol Clin North Am*. 2016;43:431-40.
- King CR, Giles D. Total laparoscopic hysterectomy and laparoscopic-assisted vaginal hysterectomy. *Obstet Gynecol Clin North Am*. 2016;43:463-78.
- Reich H, DeCaprio J, McGlynn F. Laparoscopy hysterectomy. *J Gynecol Surg*. 1989;5:13-215.
- Simpson KM, Advincula AP. The essential elements of a robotic-assisted laparoscopic hysterectomy. *Obstet Gynecol Clin North Am*. 2016;43:479-93.
- Visco A, Advincula A. Robotic gynecologic surgery. *Obstet Gynecol*. 2008;112:1369-84.
- Advincula A, Wang K. Evolving role and current state of robotics in minimally invasive gynecologic surgery. *J Minim Invasive Gynecol*. 2009;16:291-301.
- Lawrie TA, Liu H, Lu D, Dowswell T, Song H, Wang L, et al. Robot-assisted surgery in gynaecology. *Cochrane Database Syst Rev*. 2019;(4):CD011.
- De Los Ríos JF, Castañeda JD, Calle GA, Serna E, Vásquez RA, Arango AM, et al. Histerectomía laparoscópica total en la unidad de endoscopia ginecológica de la Clínica del prado, Medellín (Colombia) 2002 - 2008. *Rev Colomb Obstet. Ginecol*. 2009;60(4):320-7.
- Wright JD, Herzog TJ, Tsui J, Ananth CV, Lewin SN, Lu YS, et al. Nationwide trends in the performance of inpatient hysterectomy in the United States. *Obstet Gynecol*. 2013;122:233-41.
- Aarts JW, Nieboer TE, Johnson N, Tavender E, Garry R, Mol BW, et al. Surgical approach to hysterectomy for benign gynaecological disease. *Cochrane Database Syst Rev*. 2015;(8):CD003677.
- Turner LC, Shepherd JP, Wang L, Bunker CH, Lowder JL. Hysterectomy surgery trends: a more accurate depiction of the last decade? *Am J Obstet Gynecol*. 2013;208:277.e1-7.
- Einarsson JI, Suzuki Y. Total laparoscopic hysterectomy: 10 steps toward a successful procedure. *Rev Obstet Gynecol*. 2009;2:57-64.
- Ahmad B, Baker J, Finnerty J, Phillips K, Watson A. Laparoscopic entry techniques. *Cochrane Database Syst Rev*. 2019;(1):CD006583.
- Vilos GA, Ternamian A, Dempster J, Laberge PY. No. 193-Laparoscopic Entry: A review of techniques, technologies, and complications. *J Obstet Gynaecol Can*. 2017;39:e69-e84.
- Ghomi A, Kramer C, Askari R, Chavan NR, Einarsson JI. Trendelenburg position in gynecologic robotic-assisted surgery. *J Minim Invasive Gynecol*. 2012;19:485-9.
- Gould C, Cull T, Wu YX, Osmundsen B. Blinded measure of Trendelenburg angle in pelvic robotic surgery. *J Minim Invasive Gynecol*. 2012;19:465-8.
- Colombo R, Agarossi A, Borghi B, Ottolina D, Bergomi P, Ballone E, et al. The effect of prolonged steep head-down laparoscopy on the optical nerve sheath diameter. *J Clin Monit Comput*. 2020;34:1295-302.
- Souki FG, Rodriguez-Blanco YF, Polu SR, Eber S, Candiotti KA. Survey of anesthesiologists' practices related to steep Trendelenburg positioning in the USA. *BMC Anesthesiol*. 2018;18:117.
- Koh CH. Laparoscopic suturing in the vertical zone. Tuttingen: Endo Press; 2005.

29. Jain N, Jain V, Agarwal C, Bansal P, Gupta S, Bansal B. Left lateral port: safe laparoscopic port entry in previous large upper abdomen laparotomy scar. *J Minim Invasive Gynecol.* 2019;26:973-6.
30. Jain N, Sareen S, Kanawa S, Jain V, Gupta S, Mann S. Jain point: a new safe portal for laparoscopic entry in previous surgery cases. *J Hum Reprod Sci.* 2016;9:9-17.
31. Epstein J, Arora A, Ellis H. Surface anatomy of the inferior epigastric artery in relation to laparoscopic injury. *Clin Anat.* 2004;17:400-8.
32. Joy P, Simon B, Prithishkumar IJ, Isaac B. Topography of inferior epigastric artery relevant to laparoscopy: a CT angiographic study. *Surg Radiol Anat.* 2016;38:279-83.
33. Pickett SD, Rodewald KJ, Billow MR, Giannios NM, Hurd WW. Avoiding major vessel injury during laparoscopic instrument insertion. *Obstet Gynecol Clin North Am.* 2010;37:387-97.
34. Bogani G, Martinelli F, Ditto A, Chiappa V, Lorusso D, Ghezzi F, et al. Pneumoperitoneum pressures during pelvic laparoscopic surgery: a systematic review and meta-analysis. *Eur J Obstet Gynecol Reprod Biol.* 2015;195:1-6.
35. Topçu HO, Cavkaytar S, Kokanalı K, Guzel AI, İslimye M, Doganay M. A prospective randomized trial of postoperative pain following different insufflation pressures during gynecologic laparoscopy. *Eur J Obstet Gynecol Reprod Biol.* 2014;182:81-5.
36. ACOG Committee Opinion No. 774: Opportunistic salpingectomy as a strategy for epithelial ovarian cancer prevention. Systematic opportunity bilateral salpingectomy. *Obstet Gynecol.* 2019;133:e279-84.
37. López CC, Ríos JFL, González Y, Vásquez-Trespalcacios EM, Serna D, Arango A, et al. Barbed suture versus conventional suture for vaginal cuff closure in total laparoscopic hysterectomy: randomized controlled clinical trial. *J Minim Invasive Gynecol.* 2019;26:1104-9.
38. Yildirim D, Ozyurek SE, Kiyak H, Han A, Koroglu N, Bestel A, et al. Single-layer versus double-layer closure of the vaginal cuff with barbed sutures in laparoscopic hysterectomy. *Ginekol Pol.* 2018;89:229-34.
39. Hodgson B. AAGL practice report: Practice guidelines on the prevention of apical prolapse at the time of benign hysterectomy. *J Minim Invasive Gynecol.* 2014;21:715-22.
40. Kaloo P, Armstrong S, Kaloo C, Jordan V. Interventions to reduce shoulder pain following gynaecological laparoscopic procedures. *Cochrane Database Syst Rev.* 2019;(1):CD011101.
41. Lee J, Park C, Kim J, Ki Y, Cha SH, Kim JY. Effect of low-pressure pulmonary recruitment maneuver on postlaparoscopic shoulder pain: randomized controlled trial. *J Minim Invasive Gynecol.* 2020;27:173-7.
42. Ravndal C, Vandrevale T. Preemptive local anesthetic in gynecologic laparoscopy and postoperative movement-evoked pain: a randomized trial. *J Minim Invasive Gynecol.* 2016;23:775-80.
43. Blanton E, Lamvu G, Patanwala I, Barron KI, Witzeman K, Tu FF, et al. Non-opioid pain management in benign minimally invasive hysterectomy: a systematic review. *Am J Obstet Gynecol.* 2017;216:557-67.
44. Committee on Gynecologic Practice. ACOG Committee Opinion No. 750: Perioperative pathways: enhanced recovery after surgery. *Obstet Gynecol.* 2018;132:e120-30.
45. Carey ET, Moulder JK. Perioperative management and implementation of enhanced recovery programs in gynecologic surgery for benign indications. *Obstet Gynecol.* 2018;132:137-46.
46. Kalogera E, Dowdy SC. Enhanced recovery pathway in gynecologic surgery: improving outcomes through evidence-based medicine. *Obstet Gynecol Clin North Am.* 2016;43:551-73.