Italian Journal of
Gynæcology & Obstetrics
March 2025 - Vol. 37 - N. 1 - Quarterly - ISSN 2385 – 0868

Precision and progress: minimally invasive surgery in gynaecologic cancer treatment

Tullio **Golia D'Augè** [1,#,*], Emanuele **De Angelis** [1,#], Ilaria **Cuccu** [1], Antonio Simone **Laganà** [2], Andrea **Etrusco** [2], Violante **Di Donato** [1], Giorgio **Bogani** [3], Federico **Ferrari** [4], Enrico **Vizza** [5], Ottavia **D'Oria** [6], Donatella **Caserta** [7], Andrea **Giannini** [7]

[1] Department of Maternal and Child Health and Urological Sciences, Sapienza University of Rome, Policlinico Umberto I, Rome, Italy.
[2] Unit of Obstetrics and Gynecology, "Paolo Giaccone" Hospital, Department of Health Promotion, Mother and Child Care, Internal Medicine and Medical Specialties (PROMISE), University of Palermo, Palermo, Italy.
[3] Fondazione IRCCS Istituto Nazionale dei Tumori, Gynecological Oncology Unit, Milan, Italy.
[4] Department of Clinical and Experimental Sciences, University of Brescia, Brescia, Italy.
[5] Gynecologic Oncology Unit, Department of Experimental Clinical Oncology, IRCSS-Regina Elena National Cancer Institute, Rome, Italy.
[6] Obstetrics and Gynecological Unit, Department of Woman's and Child's Health, San Camillo-Forlanini Hospital, Rome, Italy.
[7] Unit of Gynecology, Sant'Andrea Hospital, Department of Surgical and Medical Sciences and Translational Medicine, Sapienza University of Rome, Rome, Italy.
[#] The authors contributed equally to this work.

ARTICLE INFO

History
Received: 01 August 2024
Received in revised form: 06 October 2024
Accepted: 18 December 2024
Available online: 31 March 2025

DOI: 10.36129/jog.2025.199

Key words
Minimally invasive surgery (MIS); gynaecologic cancer; laparoscopy; robotic surgery; perioperative outcomes.

***Corresponding author:** Tullio **Golia D'Augè**, M.D. Department of Maternal and Child Health and Urological Sciences, Sapienza University of Rome, Policlinico Umberto I, Rome, Italy.
Email: tullio.goliadauge@uniroma1.it.
ORCID: 0000-0002-1018-308.

ABSTRACT

Minimally invasive surgery (MIS), which comprises laparoscopy, robotic surgery, and vaginal transluminal natural endoscopic surgery (vNOTES), has gained notoriety in the setting of many gynaecologic diseases, including endometrial, ovarian, and cervical cancers. Over the years, several studies have conducted comparisons between MIS and laparotomic surgery. The predominant aspects of these techniques include less intraoperative bleeding, shorter hospitalization, accelerated postoperative recovery and lower incidence of peri- and postoperative adverse events. However, costs and operative time remain high. Articles comparing different minimally invasive surgical procedures for the management of gynaecologic cancer were reviewed. Although several articles have pointed out that the use of the surgical approach by MIS has not shown substantial differences in survival compared with laparotomy and has manifested excellent peri- and postoperative outcomes for endometrial cancer, the relevance of minimally invasive surgery for cervical and ovarian cancer remains controversial. Incipient indications suggest laparoscopic cytoreduction as an emerging procedure for appropriately selected patients following neoadjuvant chemotherapy treatment. Several scientific evidence have attested to the improved clinical parameters associated with the adoption of a minimally invasive surgical approach compared with open procedures. The preeminent goal of minimally invasive surgery should aim at optimizing oncologic outcomes and improving the health status of patients.

INTRODUCTION

Minimally invasive surgery (MIS), including laparoscopy, robotic surgery, and vaginal natural transluminal endoscopic orifice surgery (vNOTES), has been an increasingly used modality for the management of various gynaecologic conditions, including endometrial, ovarian, and cervical cancer. Over the

years, several studies have compared MIS with laparotomic surgery showing its characteristics, demonstrating its non-inferiority to open surgery [1-3]. The increased use of MIS is mainly due to its positive aspects: less intraoperative blood loss, reduced hospitalization, faster postoperative recovery and lower incidence of peri and postoperative complications [4, 5]. Unfortunately, costs and operating times, mainly for robotic surgery, remain high [6]. However, with the development of new technologies, it seems necessary to submit these methodologies to a critical evaluation to ensure that the oncologic outcomes are superior or at least equivalent to the laparotomic approach, historically considered the standard of care. Furthermore, due to the complex nature of patient populations and tumour processes, these minimally invasive approaches are not free of difficulty and the adoption of minimally invasive methodologies is currently subject to controversy, particularly concerning cervical and ovarian cancers [7-10].

In 2022, gynaecological cancers were responsible for 1,473,427 new cases and 680,372 deaths worldwide, exhibiting significant regional disparities in both incidence and mortality rates. In Europe, there were slightly over 270,000 new cases reported, with approximately 100,000 associated deaths [11].

From 2015 to 2021, a total of 246,743 hysterectomies were performed across the United States. Of these, 188,534 procedures (76%) were conducted for benign indications, while 59,209 procedures (24%) were related to gynaecologic cancer case [12]. A prevalent surgical procedure conducted within the European Union is the hysterectomy. In 2022, the highest incidence of hysterectomies was recorded in Czechia, at a rate of 146.1 per 100,000 inhabitants. In contrast, the incidence across other EU member states varied, with the Netherlands reporting a rate of 45.7 per 100,000 (based on 2021 data) and Lithuania exhibiting a higher rate of 127.4 per 100,000. Romania demonstrating the lowest rate at 7% [13]. In Europe, MIS has revolutionized the approach to gynaecologic oncology, providing safe and effective options for the treatment of gynaecologic cancers. However, the decision on the optimal surgical approach must be made in a case-by-case situation, considering the specific patient and tumour characteristics. This review aims to explore the current literature about minimally invasive surgery in gynaecological cancers, according to the most relevant and novel studies.

MATERIALS AND METHODS

The search was conducted in March 2024, by different authors independently, on different databases (MEDLINE, EMBASE, Global Health, Cochrane Database and Web of Science) to find all relevant trials. No filter about the year of publication was set. We screened articles including the following keywords: "Endometrial Cancer", "Ovarian Cancer", "Cervical Cancer", "Minimally Invasive Surgery", "Laparoscopy", "Robotic Assisted Laparoscopy", "Gynecologic Surgery". Key criteria for inclusion were: (i) English articles, (ii) original studies about minimally invasive surgery or gynaecologic surgery, (iii) studies comparing different surgeries in gynaecological cancer. Letters, editorials and case reports were excluded from this review. All articles were screened using the keywords by independent authors (TGD and EDA). The studies that met the inclusion criteria were further considered, and relevant data were extracted and analysed for each paper. The full text of these potentially eligible articles was retrieved and assessed for eligibility by other independent review team members (IC and OD). Any disagreement between them over the eligibility of some articles was resolved through discussion with an external collaborator (GB). All the studies screened through the inclusion criteria were examined, and relevant data was extracted for each paper. Two authors (TGD and EDA) independently extracted data from articles about study characteristics and included populations, types of intervention and outcomes. Due to the nature of the findings, we opted for a comprehensive synthesis of the results from selected articles.

RESULTS

Cervical cancer

In Italy, cervical cancer is the fifth most common cancer in women under the age of 50 and accounts for 1.3% of all diagnosed cancers. Worldwide, it is the third most common cancer in terms of incidence and mortality among females with an estimated 604,000 new cases and 342,000 deaths in 2020 [14]. In addition to the well-established causal effect of HPV infection in the aetiology of intraepithelial neoplasia and cervical cancer, other factors may be involved as the reactive oxygen species (ROS) and free radicals [15].

Radical hysterectomy is the standard of care for the treatment of early-stage cervical carcinoma (FIGO stage IA2-IB1) [16, 17], except for patients who desire to preserve fertility, where fertility-sparing treatment appears to be a valid option [18].
For decades, this procedure has been performed via laparotomy with excellent cure rates. In 2018, this result was validated by the LACC trial where, although similar postoperative quality of life was observed among the treatment groups [19], the 4.5-year disease-free survival (DFS) rate was found to be 86.0% with MIS and 96.5% with open surgery; similarly, a lower overall survival (OS) can be seen in minimally invasive surgery compared with open surgery [20].
In 2020, the SUCCOR study, an international observational European cohort study, analysed oncologic outcomes in IB1 cervical cancer patients undergoing radical hysterectomy. Of the 1272 patients included in the study, 693 were extracted for analysis, of whom 228 underwent radical hysterectomy by laparoscopic surgery and 63 by robotic surgery. A 4.5-year disease-free survival assessment was performed for both groups. The results indicated twice the risk of recurrence for patients treated with minimally invasive surgery compared with those undergoing open surgery ($p = 0.001$). Similarly, the risk of mortality was 2.42 times higher in the minimally invasive surgery group than in the open surgery group ($p = 0.005$). In addition, it was observed that the use of uterine manipulators would appear to be associated with decreased disease-free survival [21].
Bilal M Sert *et al*. [22] confirmed the evidence reported in previous investigations. Of the 582 patients included in the study (353 in the laparotomy cohort and 229 in the minimally invasive cohort), twice the risk of recurrence was observed in the group undergoing MIS compared with the open group (HR 2.73, 95%CI 1.56-4.80). Although MIS does not show favourable results in terms of DFS and OS compared to open surgery, recent data indicate that after radical hysterectomy, MIS has a lower rate of postoperative complications than the open procedure (31.2% *vs* 19.9%, $p < 0.001$) [23-25].
The comparison of robotic and laparoscopic surgery for the treatment of cervical cancer is a topic of growing interest in the scientific community. Both procedures represent minimally invasive surgery modalities, although they differ in their execution. Scientific studies and literature reviews have aimed to evaluate the outcomes and advantages of the two techniques in dealing with cervical cancer. However, some investigations have found no significant differences in terms of operative duration, blood loss, risk of intra- and postoperative complications, and the number of lymph nodes excised [26-28]. Currently, the choice between open and MIS depends on the surgeon's expertise, available resources, and the complexity of the specific case. Although in some studies [29], the recurrence rate would appear to be higher in laparoscopic surgery, these data are not statistically significant ($p = 0.250$).
The robotic-assisted surgical procedure manifests efficacy, safety, and viability in the setting of women with cervical cancer. Although most studies attest to parity in survival outcomes between the robotic approach and laparoscopy, there is a statistically significant reduction in postoperative complications, duration of bladder catheters and drains, and overall length of hospital stay in populations treated with the robotic technique compared to those undergoing laparoscopy ($p < 0.05$) [30]. This equivalence between the two procedures is also found when hysterectomy is combined with pelvic lymphadenectomy [31].
In recent years, single-site robotic radical hysterectomy has been explored, an advanced surgical procedure that employs robotic technology to conduct a complete hysterectomy through a single incision, with the intent of minimizing the surgical impact on the patient. This approach is technically feasible in patients with cervical carcinoma [32], showing little difference from the multiport robotic procedure, except for a lower postoperative hospital discharge and total hospital costs compared with multiport robotics ($p < 0.001$), and a reduced extent of lymph node recovery compared with multiport robotics ($p < 0.001$), as attested by this retrospective study involving 62 patients [33].
Nowadays, the natural orifice transvaginal transluminal endoscopic natural orifice surgery (vNOTES) procedure has been successfully applied in adnexal surgeries, hysterectomies, and lymphadenectomies. Scientific literature regarding this innovative technique is still limited, although studies have been conducted, both with and without the use of gas. At present, it is possible to state that both methodologies are technically feasible and safe in performing hysterectomy in the field of gynaecologic oncology [34]. Undoubtedly, scrupulous preoperative patient selection and adaptation of intraoperative techniques are a safe approach to conducting vNOTES procedures [35].

Endometrial cancer

Endometrial cancer (EC) is the most common gynaecologic cancer and 6th most common cause of cancer death among women worldwide [36]. Its incidence is increasing year after year in every ethnic population and in 2020 more than 417,000 new EC cases were diagnosed, with nearly 100.000 deaths [37].

Surgery is the most important treatment for endometrial cancer, which includes peritoneal fluid aspiration, total extrafascial hysterectomy combined with bilateral salpingo-oophorectomy, and in selected cases, omentectomy and sentinel lymph node biopsy [38-40], however, a more conservative approach should be considered for women desiring fertility preservation [41]. Etrusco *et al*. demonstrated how fertility-sparing treatment may represent a feasible and safe option for women of childbearing age diagnosed with Grade 2 endometrial cancer [42].

In the 1990s, the use of minimally invasive surgery was introduced to achieve complete surgical staging of endometrial cancer. The Gynecologic Oncology Group (GOG) conducted a prospective randomized trial to compare laparotomy with laparoscopy (GOG-LAP2 trial). This study involved 2616 patients with endometrial cancer and showed that laparoscopic surgery for uterine cancer is feasible and has a better safety profile than the same procedure performed by laparotomy. The 5-year overall survival was 90% in both groups, but length of hospitalization, pain, postoperative complications, and quality of life were better in the laparoscopic group [43].

Over the years since the conclusion of the LAP2 trial, numerous studies, both randomized and non-randomized, have been conducted to evaluate and compare the use of MIS with laparotomy surgery in the context of endometrial cancer. Numerous investigations highlight that the surgical approach using MIS not only did not manifest significant differences in survival outcomes compared with laparotomy but showed superior peri- and postoperative outcomes [44, 45].

After the introduction of laparoscopy, the evolution of minimally invasive surgery continued with the advent of robotic surgery. Beginning in 2005, robotic surgery for endometrial carcinoma rapidly gained popularity. It has demonstrated comparable oncologic outcomes, with reduced length of hospital stay, fewer complications, and lower conversion rates than laparoscopy. However, it is associated with higher costs than laparoscopy, and numerous scientific investigations confirm its safety and efficacy, especially in obese patients [46-48].

Currently, although there are few randomized trials comparing robotics with laparoscopy and laparotomy, we can say that the conversion rate, blood loss, and length of hospitalization are lower in the robotic group, in contrast to a significantly higher cost and longer operative time [49-51].

Despite the advantageous features of the robotic-assisted surgical procedure compared to laparotomic surgery, some research reveals that the recurrence rate is statistically higher in the group of patients treated by robotic procedure than in those who underwent laparotomic surgery. These conclusions emerge from a retrospective study conducted on a cohort of 135 patients with stage I endometrial carcinoma with intermediate-risk endometrioid features. The analysis significantly demonstrated that the five-year disease-free survival rate was higher in the group of patients who underwent laparotomic surgery (100%) than in those who underwent the robotic procedure (91.8%) ($p = 0.005$) [52].

A similar result was found in a further retrospective study involving a cohort of just over 1,000 patients. This study focused on the comparison of two minimally invasive surgical techniques: laparoscopy and robot-assisted surgery. The conclusion from this investigation was that patients who underwent robotic surgery had poorer disease-free survival than those who underwent laparoscopy ($p = 0.04$) [53].

An important consideration in minimally invasive surgery concerns the use of the uterine manipulator. Over the years, concerns have emerged that the use of the uterine manipulator may increase the risk of dissemination of early-stage disease and lead to a higher incidence of recurrence. In 2013, a randomized trial [54] appeared to end this concern, demonstrating in a sample of 110 randomized patients that implementation of uterine manipulation systems did not generate a significant increase in rates of positive peritoneal cytology or lymphovascular space invasion. About 8 years later, a large retrospective study conducted by Pablo Padilla-Iserte *et al*. [55], involving more than 2,500 patients (1756 undergoing hysterectomy with uterine manipulator and 905 without), showed that the recurrence rate in endometrial cancer was 11.69% in the group with uterine manipulator and 7.4% in the group without manipulator ($p < 0.001$). At present, there is still no clear consensus on this issue.

Among the innovations introduced in robotic surgery, in recent years total hysterectomy with bilate-

ral salpingo-oophorectomy and lymphadenectomy has been performed through the "single port" robotic technique [56, 57], leaving a scar of slightly more than 2 cm. With a multichannel system consisting of a five-lumen port, access is provided to the instruments to perform the procedure. These studies, although characterized by a limited cohort, have found the feasibility of the surgical procedure in endometrial carcinoma with the consequence of leaving a unique small scar. Using a multichannel system consisting of a five-lumen port, access is provided to the instruments needed to conduct the procedure. These studies, while presenting a limited cohort, have identified the feasibility of this surgical procedure in the context of low-risk endometrial cancer.

In recent years, the vNOTES approach has also gained acceptance for the treatment of early-stage endometrial cancer, proving to be safe and feasible. This method has also been successfully applied in patients undergoing sentinel lymph node biopsy and/or bilateral pelvic lymphadenectomy. Available studies indicate the feasibility of the vNOTES procedure, with the prospect of reduced postoperative hospital stay, more timely recovery, and superior cosmetic results [58,59]. In 2021 Emre Mat *et al.*, although on a limited cohort of 6 patients, highlighted the increased benefits offered by the vNOTES procedure to obese patients when performed by an experienced surgeon [60].

Ovarian cancer

Ovarian cancer affects thousands of women every year and represents the female cancer with the highest mortality rate, with an estimated 13,270 deaths in the US in 2023 [61, 62]. Its prevalence is highest in the female cohort over the age of fifty; however, it is likely to occur in any age group. Its high mortality is attributable to early clinical identification, which often occurs in advanced stages, regarding stages III-IV according to the International Federation of Gynecology and Obstetrics (FIGO) classification. Traditionally, ovarian cancer has been managed mainly through a complete staging surgical approach by laparotomy: bilateral salpingo-oophorectomy, abdominal hysterectomy, omentectomy, aortic and pelvic lymphadenectomy, as well as peritoneal biopsies and peritoneal washing. Minimally invasive surgery in the treatment of ovarian cancer has gradually emerged as the predominant therapeutic modality in recent years. This surgical methodology is focused on minimizing the impact on the patient's body. Laparoscopic surgery in early-stage ovarian cancer was first described in the mid-1990s [63]. Since then, several studies have been published evaluating the safety, feasibility, and potential benefits of laparoscopic surgical staging of ovarian tumours [64, 65]. Laparoscopy offers multiple advantages with better clinical outcomes in terms of less postoperative pain, less blood loss and shorter hospital stay than laparotomy [66]. In contrast, laparoscopy has disadvantages such as the inability to palpate lymph nodes, rupture of the ovary capsule, and the risk of metastasis at the trocar site [67]. Laparoscopy can also be used to perform complete debulking surgery in patients with ovarian carcinoma or recurrent ovarian carcinoma. This is shown by a retrospective study conducted by Gallotta *et al*. [68], who demonstrated that in 58 patients with recurrent ovarian carcinoma, complete debulking was documented in all cases. Intraoperative complications had a rate of 6.8%, while early postoperative complications were recorded at 10.3%, with only one grade 3 complication. The median PFS was found to be 28 months, with a second-year PFS of 58.7%. This investigation highlights the feasibility and safety of the laparoscopic approach for optimal cytoreduction in patients with recurrent ovarian cancer. Laparoscopic cytoreduction could be a new procedure for appropriately selected patients following neoadjuvant chemotherapy treatment. Aletti *et al*. [69] have shown that minimal invasive interval debulking surgery (MI-IDS) appears to be feasible and safe for patients manifesting a clinically complete response to neoadjuvant therapy. A residual tumour size of 0 cm was achieved in 96.6% of subjects, with no early postoperative complications observed.

Although laparotomy has traditionally been the predominant approach, Pecorino *et al*. highlighted the efficacy of minimally invasive methods in both staging and fertility-sparing interventions for ovarian borderline tumours [70].

In addition, the application of a psychometric test revealed the presence of moderate distress in the vast majority of patients, thus demonstrating the relevance of psycho-oncological assessments in the context of such surgical procedures. Over time, MIS has progressively consolidated its position, and several scientific investigations attest that MIS does not appear to be inferior to laparotomic surgery for ovarian cancer staging. Moreover, such research highlights peri- and postoperative advantages,

positively reflecting on surgical outcomes [71, 72]. Over the years, robotic-assisted surgery has also gained relevance in the field of gynaecologic oncology. Perioperative results show comparability between conventional laparoscopy and the robotic approach, both in the early stages and in advanced or recurrent disease [73]. The long-term prospects for the clinical outcomes of robot-assisted laparoscopy in patients with ovarian cancer are insufficiently investigated. B Facer's study [74], conducted on a cohort of approximately 1900 patients undergoing MIS, revealed no disparity in overall mortality between the robot-assisted laparoscopic approach and conventional laparoscopy. Although robot-assisted laparoscopy was associated with a lower incidence of conversion to open surgery, no significant divergence in survival was shown between patients undergoing robot-assisted laparoscopy and those undergoing conventional laparoscopy.

DISCUSSION

Minimally invasive surgery in gynaecology consists of a set of surgical procedures aimed at treating gynaecologic conditions using less invasive surgical approaches than traditional open practices to minimize patients' traumatic impact. Over the years, the adoption of MIS has progressively grown. For example, in 2006, only 2 % of radical hysterectomy procedures were performed by laparoscopy, while in 2010, the laparoscopic rate increased to 23%, with 10% of procedures performed using robot-assisted surgery. At the same time, the rate of open radical hysterectomies decreased from 98% to 67% [75]. The analysis conducted shows that, especially in large hospitals, there is a greater propensity to adopt minimally invasive surgical approaches.

In this study, we conducted a synthesis of the available evidence regarding the impact of MIS in the management of major ovarian, cervical, and endometrial malignancies. The findings not only reflect the inherent surgical advantages of this modality but also highlight the oncologic benefits. One of the highlights is undoubtedly the cosmetic outcome resulting from this procedure.

Since the introduction of this surgical methodology, the focus has been progressively turned to minimizing the size of scars [76], simultaneously promoting an improvement in patient's quality of life. Furthermore, it can also positively affect the psychological side of patients. This is corroborated by a survey conducted by Gueli Alletti S. *et al*. [77] which found statistically significant differences in favour of MI-IDS by psychometric evaluation in women with advanced ovarian cancer. In addition, we are currently able to exploit natural anatomical orifices, consequently reducing the scarring footprint in patients' bodies [78], highlighting how minimally invasive procedures induce a reduced level of pain, facilitating faster recovery for patients [79].

Surgeons sometimes prefer a minimally invasive approach to perform lymphadenectomy in gynaecologic neoplastic settings; in fact, its positive effect is mainly manifested in surgical outcomes, with reduced length of hospital stay (11.6 *vs* 16.9 days, $p < 0.001$) and lower mean estimated blood loss (220 *vs* 531 mL, $p = 0.002$) [80].

The decreased blood losses observed can also be attributed to the utilization of novel electrocautery haemostasis methods [81]. Although the recent electrocautery devices appear as appealing and potentially safer options, there is currently insufficient evidence to declare one vascular sealing technology superior to another.

During minimally invasive procedures, the adoption of new methods, such as the use of indocyanine green, is becoming increasingly common as a support for the surgeon. Recently, to prevent pelvic organ injuries during laparoscopic procedures, the use of indocyanine green has been shown to be effective in identifying the course of the ureters [82]. In addition, minimally invasive methodologies can also be used for more complex procedures, such as eviscerations for malignant neoplastic disease. The investigation by Puntambekar S. *et al*. documented the feasibility of such a procedure in 10 patients with advanced gynaecologic neoplastic disease [83]. Of course, carefully selected patients could achieve a survival benefit by obtaining a residual tumour equal to 0.

Minimally invasive surgery is now employed in almost all procedures related to benign gynaecological pathologies. Contemporary surgical techniques increasingly prioritise minimising invasiveness to reduce patient trauma, mitigate complications and promote faster recovery. Ahmed Elmaasrawy *et al*. demonstrated that the transvaginal endoscopic approach for the removal of benign adnexal masses has numerous advantages over the traditional transumbilical method [84, 85].

CONCLUSIONS

Over the past two decades, minimally invasive surgical methodologies have sparked a revolution in the field of gynaecologic oncology. Several scientific evidence attested to the improvement in clinical outcomes associated with the adoption of a minimally invasive approach in comparison with open procedures. Both conventional laparoscopy and robotic-assisted surgery manifest significant advantages, and the preference between the two modalities often depends on the surgeon's decisions. It has been widely found that minimally invasive surgery not only results in substantial benefits to the patient but also helps to reduce hospital stay time and perioperative complications. The goal of surgery should materialize in optimizing oncologic outcomes and optimizing patient health, concomitant with rationalization of associated costs. The further and broader adoption of these techniques in clinical practice seems promising for improving surgical outcomes and improving the post-operative experience for patients undergoing surgery for gynaecological malignancy.

Implications

The evidence of higher recurrence and mortality rates associated with minimally invasive surgery compared to open surgery in cervical cancer highlights the importance of guidelines and of promoting appropriate training for surgeons. Furthermore, the observation of lower postoperative complications with robotic surgery suggests that, although it may be more expensive, it may be a preferable option for selected patients, especially in settings where rapid recovery is crucial. The increasing incidence of endometrial and ovarian cancer requires an organised response from healthcare systems, including not only the adoption of safer and more effective surgical techniques, but also a multidisciplinary approach that considers the psychological and social aspects of patients. Finally, innovation in surgery, such as vNOTES techniques, opens new possibilities for less invasive interventions, necessitating continuous critical evaluation and adaptation of clinical practices based on solid evidence.

COMPLIANCE WITH ETHICAL STANDARDS

Authors' contribution

A.G., G.B., V.D.D.: Conceptualization, project administration. O.D., I.C.: Methodology, data collection. A.S.L., A.E.: Investigation, data curation. T.G.D., E.D.A.: Visualization, writing – original draft, writing – review & editing. E.V., D.C.: Supervision.

Funding

None.

Study registration

N/A.

Disclosure of interests

The authors declare that they have no conflict of interest.

Ethical approval

N/A.

Informed consent

N/A.

Data sharing

All data generated or analysed during this study are included in this published article.

REFERENCES

1. Brandt B, Sioulas V, Basaran D, Kuhn T, LaVigne K, Gardner GJ, et al. Minimally invasive surgery versus laparotomy for radical hysterectomy in the management of early-stage cervical cancer: Survival outcomes. Gynecologic Oncology. 2020;156(3):591-7. doi: 10.1016/j.ygyno.2019.12.038.
2. Odetto D, Rey Valzacchi GM, Ostojich M, Alessandria S, Darin MC, Tapper K, et al. Minimally invasive surgery versus laparotomy in women with high risk endometrial cancer: A multi-center study performed in Argentina. Gynecologic Oncology Reports. 2023;46:101147. doi: 10.1016/j.gore.2023.101147.
3. Bizzarri N, Chiantera V, Loverro M, Sozzi G, Perrone E, Gueli Alletti S, et al. Minimally invasive versus open pelvic exenteration in gynecological malignancies: a propensity-matched survival analysis. Int J Gynecol Cancer. 2023;33(2):190-7. doi: 10.1136/ijgc-2022-003954.
4. Chaccour C, Giannini A, Golia D'Augè T, Ayed A, Allahqoli L, Alkatout I, et al. Hysterectomy Using Vaginal Natural Orifice Transluminal Endoscopic Surgery Compared with Classic Laparoscopic Hysterectomy: A New Advan-

tageous Approach? A Systematic Review on Surgical Outcomes. Gynecol Obstet Invest. 2023;88(4):187-96. doi: 10.1159/000530797.
5. Giannini A, D'Oria O, Bogani G, Di Donato V, Vizza E, Chiantera V, et al. Hysterectomy: Let's Step Up the Ladder of Evidence to Look Over the Horizon. J Clin Med. 2022;11(23):6940. doi: 10.3390/jcm11236940.
6. Silva E Silva A, de Carvalho JPM, Anton C, Fernandes RP, Baracat EC, Carvalho JP. Introduction of robotic surgery for endometrial cancer into a Brazilian cancer service: a randomized trial evaluating perioperative clinical outcomes and costs. Clinics (Sao Paulo). 2018;73(suppl 1):e522s. doi: 10.6061/clinics/2017/e522s.
7. Finch L, Chi DS. An overview of the current debate between using minimally invasive surgery versus laparotomy for interval cytoreductive surgery in epithelial ovarian cancer. J Gynecol Oncol. 2023;34(5):e84. doi: 10.3802/jgo.2023.34.e84.
8. Pecorino B, D'Agate MG, Scibilia G, Scollo P, Giannini A, Di Donna MC, et al. Evaluation of Surgical Outcomes of Abdominal Radical Hysterectomy and Total Laparoscopic Radical Hysterectomy for Cervical Cancer: A Retrospective Analysis of Data Collected before the LACC Trial. IJERPH. 2022;19(20):13176. doi: 10.3390/ijerph192013176.
9. Bogani G, Ghezzi F, Chiva L, Gisone B, Pinelli C, Dell'Acqua A, et al. Patterns of recurrence after laparoscopic versus open abdominal radical hysterectomy in patients with cervical cancer: a propensity-matched analysis. Int J Gynecol Cancer. 2020;30(7):987-92. doi: 10.1136/ijgc-2020-001381.
10. Bogani G, DI Donato V, Chiappa V, Lopez S, Monti M, Muzii L, et al. Minimally invasive surgery in cervical cancer. Minerva Obstet Gynecol. 2021;73(2):145-8. doi: 10.23736/S2724-606X.20.04726-7.
11. Zhu B, Gu H, Mao Z, Beeraka NM, Zhao X, Anand MP, et al. Global burden of gynaecological cancers in 2022 and projections to 2050. J Glob Health. 2024;14:04155. doi: 10.7189/jogh.14.04155.
12. Holtzman S, Gellman C, Kaplowitz E, Barber E, Huh W, Blank SV. Yes, it's true: Benign hysterectomy trends for gynecologic oncologists in the United States from 2015 to 2021. Gynecologic Oncology. 2024;189:125-128. doi: 10.1016/j.ygyno.2024.07.670.
13. Surgical operations and procedures statistics. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Surgical_operations_and_procedures_statistics. Accessed on October 5, 2024.
14. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA Cancer J Clin. 2021;71(3):209-49. doi: 10.3322/caac.21660.
15. Despot A, Fureš R, Despot A-M, Mikuš M, Zlopaša G, D'Amato A, et al. Reactive oxygen species within the vaginal space: An additional promoter of cervical intraepithelial neoplasia and uterine cervical cancer development? Open Med (Wars). 2023;18(1):20230826. doi: 10.1515/med-2023-0826.
16. Cibula D, Raspollini MR, Planchamp F, Centeno C, Chargari C, Felix A, et al. ESGO/ESTRO/ESP Guidelines for the management of patients with cervical cancer - Update 2023. Int J Gynecol Cancer. 2023;33(5):649-66. doi: 10.1136/ijgc-2023-004429.
17. Giannini A, D'Oria O, Chiantera V, Margioula-Siarkou C, Di Donna MC, Terzic S, et al. Minimally Invasive Surgery for Cervical Cancer: Should We Look beyond Squamous Cell Carcinoma? J Invest Surg. 2022;35(7):1602-3. doi: 10.1080/08941939.2022.2075495.
18. D'Amato A, Riemma G, Agrifoglio V, Chiantera V, Laganà AS, Mikuš M, et al. Reproductive Outcomes in Young Women with Early-Stage Cervical Cancer Greater than 2 cm Undergoing Fertility-Sparing Treatment: A Systematic Review. Medicina (Kaunas). 2024;60(4):608. doi: 10.3390/medicina60040608.
19. Frumovitz M, Obermair A, Coleman RL, Pareja R, Lopez A, Ribero R, et al. Quality of life in patients with cervical cancer after open versus minimally invasive radical hysterectomy (LACC): a secondary outcome of a multicentre, randomised, open-label, phase 3, non-inferiority trial. Lancet Oncol. 2020;21(6):851-60. doi: 10.1016/S1470-2045(20)30081-4.
20. Ramirez PT, Frumovitz M, Pareja R, Lopez A, Vieira M, Ribeiro R, et al. Minimally Invasive versus Abdominal Radical Hysterectomy for Cervical Cancer. N Engl J Med. 2018;379(20):1895-904. doi: 10.1056/NEJMoa1806395.
21. Chiva L, Zanagnolo V, Querleu D, Martin-Calvo N, Arévalo-Serrano J, Căpîlna ME, et al. SUC-

COR study: an international European cohort observational study comparing minimally invasive surgery versus open abdominal radical hysterectomy in patients with stage IB1 cervical cancer. Int J Gynecol Cancer. 2020;30(9):1269-77. doi: 10.1136/ijgc-2020-001506.
22. Sert BM, Kristensen GB, Kleppe A, Dørum A. Long-term oncological outcomes and recurrence patterns in early-stage cervical cancer treated with minimally invasive versus abdominal radical hysterectomy: The Norwegian Radium Hospital experience. Gynecol Oncol. 2021;162(2):284-91. doi: 10.1016/j.ygyno.2021.05.028.
23. Bogani G, Ghezzi F, Chiva L, Gisone B, Pinelli C, Dell'Acqua A, et al. Patterns of recurrence after laparoscopic versus open abdominal radical hysterectomy in patients with cervical cancer: a propensity-matched analysis. Int J Gynecol Cancer. 2020;30(7):987-92. doi: 10.1136/ijgc-2020-001381.
24. Kohut AY, Kuhn T, Conrad LB, Chua KJ, Abuelafiya M, Gordon AN, et al. Thirty-day Postoperative Adverse Events in Minimally Invasive versus Open Abdominal Radical Hysterectomy for Early-stage Cervical Cancer. J Minim Invasive Gynecol. 2022;29(7):840-7. doi: 10.1016/j.jmig.2022.03.014.
25. Bogani G, Donato VD, Scambia G, Landoni F, Ghezzi F, Muzii L, et al. Practice patterns and 90-day treatment-related morbidity in early-stage cervical cancer. Gynecol Oncol. 2022;166(3):561-6. doi: 10.1016/j.ygyno.2022.07.022.
26. Corrado G, Fanfani F, Ghezzi F, Fagotti A, Uccella S, Mancini E, et al. Mini-laparoscopic versus robotic radical hysterectomy plus systematic pelvic lymphadenectomy in early cervical cancer patients. A multi-institutional study. European Journal of Surgical Oncology (EJSO). 2015;41(1):136-41. doi: 10.1016/j.ejso.2014.10.048.
27. Gallotta V, Conte C, Federico A, Vizzielli G, Gueli Alletti S, Tortorella L, et al. Robotic versus laparoscopic radical hysterectomy in early cervical cancer: A case matched control study. European Journal of Surgical Oncology. 2018;44(6):754-9. doi: 10.1016/j.ejso.2018.01.092.
28. Corrado G, Anchora LP, Bruni S, Sperduti I, Certelli C, Chiofalo B, et al. Patterns of recurrence in FIGO stage IB1-IB2 cervical cancer: Comparison between minimally invasive and abdominal radical hysterectomy. European Journal of Surgical Oncology. 2023;49(11):107047. doi: 10.1016/j.ejso.2023.107047.
29. Kim SI, Yoo JG, Lee SJ, Park DC, Yoon JH. Robot-assisted versus conventional laparoscopic radical hysterectomy in cervical cancer stage IB1. Int J Med Sci. 2023;20(3):287-91. doi: 10.7150/ijms.79830.
30. Luo C, Liu M, Li X. Efficacy and safety outcomes of robotic radical hysterectomy in Chinese older women with cervical cancer compared with laparoscopic radical hysterectomy. BMC Womens Health. 2018;18(1):61. doi: 10.1186/s12905-018-0544-x.
31. Nezhat FR, Datta MS, Liu C, Chuang L, Zakashansky K. Robotic radical hysterectomy versus total laparoscopic radical hysterectomy with pelvic lymphadenectomy for treatment of early cervical cancer. JSLS. 2008;12(3):227-37.
32. Vizza E, Chiofalo B, Cutillo G, Mancini E, Baiocco E, Zampa A, et al. Robotic single site radical hysterectomy plus pelvic lymphadenectomy in gynecological cancers. J Gynecol Oncol. 2018;29(1):e2. doi: 10.3802/jgo.2018.29.e2.
33. Jang T-K, Chung H, Kwon S-H, Shin S-J, Cho C-H. Robotic single-site versus multiport radical hysterectomy in early stage cervical cancer: An analysis of 62 cases from a single institution. Int J Med Robot. 2021;17(4):e2255. doi: 10.1002/rcs.2255.
34. Mei Y, He L, Zhang Q, Chen Y, Zheng J, Xiao X, et al. The comparison of gasless and traditional robot-assisted transvaginal natural orifice transluminal endoscopic surgery in hysterectomy. Front Med (Lausanne). 2023;10:1117158. doi: 10.3389/fmed.2023.1117158.
35. Hurni Y, Romito F, Huber DE. Is transvaginal natural orifice transluminal endoscopic surgery (vNOTES) indicated in patients with previous extensive pelvic surgeries? A case report. Case Rep Womens Health. 2022;34:e00397. doi: 10.1016/j.crwh.2022.e00397.
36. Siegel RL, Miller KD, Fuchs HE, Jemal A. Cancer Statistics, 2021. CA Cancer J Clin. 2021;71(1):7-33. doi: 10.3322/caac.21654.
37. Comprehensive Cancer Information - NCI. Available at: https://www.cancer.gov/. Accessed on November 19, 2023.
38. Querleu D, Morrow CP. Classification of radical hysterectomy. Lancet Oncol. 2008;9(3):297-303. doi: 10.1016/S1470-2045(08)70074-3.
39. Bogani G, Ditto A, Leone Roberti Maggiore U, Lorusso D, Raspagliesi F. Sentinel-lymph-node mapping in endometrial cancer.

Lancet Oncol. 2017;18(5):e234. doi: 10.1016/S1470-2045(17)30247-4.
40. Cuccu I, Raspagliesi F, Malzoni M, Vizza E, Papadia A, Di Donato V, et al. Sentinel node mapping in high-intermediate and high-risk endometrial cancer: Analysis of 5-year oncologic outcomes. Eur J Surg Oncol. 2024;50(4):108018. doi: 10.1016/j.ejso.2024.108018.
41. Gullo G, Etrusco A, Cucinella G, Perino A, Chiantera V, Laganà AS, et al. Fertility-Sparing Approach in Women Affected by Stage I and Low-Grade Endometrial Carcinoma: An Updated Overview. Int J Mol Sci. 2021;22(21):11825. doi: 10.3390/ijms222111825.
42. Etrusco A, Laganà AS, Chiantera V, Mikuš M, Arsalan HM, d'Amati A, et al. Reproductive and Oncologic Outcomes in Young Women with Stage IA and Grade 2 Endometrial Carcinoma Undergoing Fertility-Sparing Treatment: A Systematic Review. Biomolecules. 2024;14(3):306. doi: 10.3390/biom14030306.
43. Walker JL, Piedmonte MR, Spirtos NM, Eisenkop SM, Schlaerth JB, Mannel RS, et al. Recurrence and survival after random assignment to laparoscopy versus laparotomy for comprehensive surgical staging of uterine cancer: Gynecologic Oncology Group LAP2 Study. J Clin Oncol. 2012;30(7):695-700. doi: 10.1200/JCO.2011.38.8645.
44. Jung J, Noh JJ, Choi CH, Kim T-J, Lee J-W, Kim B-G, et al. Minimally-Invasive Versus Abdominal Hysterectomy for Endometrial Carcinoma With Glandular or Stromal Invasion of Cervix. Front Oncol. 2021;11:670214. doi: 10.3389/fonc.2021.670214.
45. Reijntjes B, Van Suijlichem M, Woolderink JM, Bongers MY, Reesink-Peters N, Paulsen L, et al. Recurrence and survival after laparoscopy versus laparotomy without lymphadenectomy in early-stage endometrial cancer: Long-term outcomes of a randomised trial. Gynecologic Oncology. 2022;164(2):265-70. doi: 10.1016/j.ygyno.2021.12.019.
46. Burke WM, Gossner G, Goldman NA. Robotic Surgery in the Obese Gynecologic Patient. Clin Obstet Gynecol. 2011;54(3):420-30. doi: 10.1097/GRF.0b013e31822b37b1.
47. Paley PJ, Veljovich DS, Shah CA, Everett EN, Bondurant AE, Drescher CW, et al. Surgical outcomes in gynecologic oncology in the era of robotics: analysis of first 1000 cases. Am J Obstet Gynecol. 2011;204(6):551.e1-551.e9. doi: 10.1016/j.ajog.2011.01.059.
48. Corrado G, Chiantera V, Fanfani F, Cutillo G, Lucidi A, Mancini E, et al. Robotic Hysterectomy in Severely Obese Patients With Endometrial Cancer: A Multicenter Study. Journal of Minimally Invasive Gynecology. 2016;23(1):94-100. doi: 10.1016/j.jmig.2015.08.887.
49. Mäenpää MM, Nieminen K, Tomás EI, Laurila M, Luukkaala TH, Mäenpää JU. Robotic-assisted vs traditional laparoscopic surgery for endometrial cancer: a randomized controlled trial. Am J Obstet Gynecol. 2016;215(5):588.e1-588.e7. doi: 10.1016/j.ajog.2016.06.005.
50. Vuorinen R-LK, Mäenpää MM, Nieminen K, Tomás EI, Luukkaala TH, Auvinen A, et al. Costs of Robotic-Assisted Versus Traditional Laparoscopy in Endometrial Cancer: Int J Gynecol Cancer. 2017;27(8):1788-93. doi: 10.1097/IGC.0000000000001073.
51. Salehi S, Åvall-Lundqvist E, Legerstam B, Carlson JW, Falconer H. Robot-assisted laparoscopy versus laparotomy for infrarenal paraaortic lymphadenectomy in women with high-risk endometrial cancer: A randomised controlled trial. Eur J Cancer. 2017;79:81-89. doi: 10.1016/j.ejca.2017.03.038.
52. Song J, Le T, Hopkins L, Fung-Kee-Fung M, Lupe K, Gaudet M, et al. A comparison of disease recurrence between robotic versus laparotomy approach in patients with intermediate-risk endometrial cancer. Int J Gynecol Cancer. 2020;30(2):160-6. doi: 10.1136/ijgc-2019-000838.
53. Argenta PA, Mattson J, Rivard CL, Luther E, Schefter A, Vogel RI. Robot-assisted versus laparoscopic minimally invasive surgery for the treatment of stage I endometrial cancer. Gynecol Oncol. 2022;165(2):347-52. doi: 10.1016/j.ygyno.2022.03.007.
54. Lee M, Kim YT, Kim SW, Kim S, Kim JH, Nam EJ. Effects of uterine manipulation on surgical outcomes in laparoscopic management of endometrial cancer: a prospective randomized clinical trial. Int J Gynecol Cancer. 2013;23(2):372-9. doi: 10.1097/IGC.0b013e3182788485.
55. Padilla-Iserte P, Lago V, Tauste C, Díaz-Feijoo B, Gil-Moreno A, Oliver R, et al. Impact of uterine manipulator on oncological outcome in endometrial cancer surgery. Am J Obstet Gynecol. 2021;224(1):65.e1-65.e11. doi: 10.1016/j.ajog.2020.07.025.

56. Vizza E, Corrado G, Mancini E, Baiocco E, Patrizi L, Fabrizi L, et al. Robotic Single-site Hysterectomy in Low Risk Endometrial Cancer: A Pilot Study. Ann Surg Oncol. 2013;20(8):2759-64. doi: 10.1245/s10434-013-2922-9.
57. Yoon A, Yoo H-N, Lee Y-Y, Lee J-W, Kim B-G, Bae D-S, et al. Robotic Single-port Hysterectomy, Adnexectomy, and Lymphadenectomy in Endometrial Cancer. J Min Inv Gynecol. 2015;22(3):322. doi: 10.1016/j.jmig.2014.12.003.
58. Lee C-L, Liu H-M, Khan S, Lee P-S, Huang K-G, Yen C-F. Vaginal natural ori ice transvaginal endoscopic surgery (vNOTES) surgical staging for endometrial carcinoma: The feasibility of an innovative approach. Taiwanese J Obstet Gynecol. 2022;61(2):345-52. doi: 10.1016/j.tjog.2022.02.026.
59. Wang Y, Deng L, Tang S, Dou Y, Yao Y, Li Y, et al. vNOTES Hysterectomy with Sentinel Lymph Node Mapping for Endometrial Cancer: Description of Technique and Perioperative Outcomes. Journal of Minimally Invasive Gynecology. 2021;28(6):1254-61. doi: 10.1016/j.jmig.2021.01.022.
60. Mat E, Kale A, Gundogdu EC, Basol G, Yildiz G, Usta T. Transvaginal natural ori ice endoscopic surgery for extremely obese patients with early-stage endometrial cancer. J Obstet Gynaecol Res. 2021;47(1):262-9. doi: 10.1111/jog.14509.
61. Cancer of the Ovary - Cancer Stat Facts. SEER. Available at: https://seer.cancer.gov/statfacts/html/ovary.html. Accessed on March 29, 2024.
62. Ovarian Cancer Statistics | How Common is Ovarian Cancer. Available at: https://www.cancer.org/cancer/types/ovarian-cancer/about/key-statistics.html. Accessed on March 29, 2024.
63. Querleu D, LeBlanc E. Laparoscopic infrarenal paraaortic lymph node dissection for restaging of carcinoma of the ovary or fallopian tube. Cancer. 1994;73(5):1467-71. doi: 10.1002/1097-0142(19940301)73:5<1467::aid-cncr2820730524>3.0.co;2-b.
64. Pomel C, Provencher D, Dauplat J, Gauthier P, Le Bouedec G, Drouin P, et al. Laparoscopic staging of early ovarian cancer. Gynecol Oncol. 1995;58(3):301-6. doi: 10.1006/gyno.1995.1234.
65. Benedetti Panici P, Giannini A, Fischetti M, Lecce F, Di Donato V. Lymphadenectomy in Ovarian Cancer: Is It Still Justi ied? Curr Oncol Rep. 2020;22(3):22. doi: 10.1007/s11912-20-0883-2.
66. Brown J, Drury L, Crane EK, Anderson WE, Tait DL, Higgins RV, et al. When Less Is More: Minimally Invasive Surgery Compared with Laparotomy for Interval Debulking After Neoadjuvant Chemotherapy in Women with Advanced Ovarian Cancer. J Minim Invasive Gynecol. 2019;26(5):902-9. doi: 10.1016/j.jmig.2018.09.765.
67. Lee C-L, Kay N, Chen H-L, Yen C-F, Huang K-G. The roles of laparoscopy in treating ovarian cancer. Taiwan J Obstet Gynecol. 2009;48(1):9-14. doi: 10.1016/S1028-4559(09)60029-2.
68. Gallotta V, Conte C, Giudice MT, Nero C, Vizzielli G, Gueli Alletti S, et al. Secondary Laparoscopic Cytoreduction in Recurrent Ovarian Cancer: A Large, Single-Institution Experience. J Minim Invasive Gynecol. 2018;25(4):644-50. doi: 10.1016/j.jmig.2017.10.024.
69. Gueli Alletti S, Bottoni C, Fanfani F, Gallotta V, Chiantera V, Costantini B, et al. Minimally invasive interval debulking surgery in ovarian neoplasm (MISSION trial-NCT02324595): a feasibility study. Am J Obstet Gynecol. 2016;214(4):503.e1-503.e6. doi: 10.1016/j.ajog.2015.10.922.
70. Pecorino B, Laganà AS, Mereu L, Ferrara M, Carrara G, Etrusco A, et al. Evaluation of Borderline Ovarian Tumor Recurrence Rate after Surgery with or without Fertility-Sparing Approach: Results of a Retrospective Analysis. Healthcare (Basel). 2023;11(13):1922. doi: 10.3390/healthcare11131922.
71. Ghezzi F, Cromi A, Uccella S, Bergamini V, Tomera S, Franchi M, et al. Laparoscopy versus laparotomy for the surgical management of apparent early stage ovarian cancer. Gynecologic Oncology. 2007;105(2):409-13. doi: 10.1016/j.ygyno.2006.12.025.
72. Eriksson AGZ, Graul A, Yu MC, Halko A, Chi DS, Zivanovic O, et al. Minimal access surgery compared to laparotomy for secondary surgical cytoreduction in patients with recurrent ovarian carcinoma: Perioperative and oncologic outcomes. Gynecologic Oncology. 2017;146(2):263-7. doi: 10.1016/j.ygyno.2017.05.022.
73. Nezhat FR, Finger TN, Vetere P, Radjabi AR, Vega M, Averbuch L, et al. Comparison of perioperative outcomes and complication rates between conventional versus robotic-assisted laparoscopy in the evaluation and management of early, advanced, and recurrent stage ovarian, fallopian tube, and primary peritoneal can-

cer. Int J Gynecol Cancer. 2014;24(3):600-7. doi: 10.1097/IGC.0000000000000096.
74. Facer B, Wang F, Grijalva CG, Alvarez RD, Shu X-O. Survival outcomes for robotic-assisted laparoscopy versus traditional laparoscopy in clinical stage I epithelial ovarian cancer. Am J Obstet Gynecol. 2020;222(5):474.e1-474.e12. doi: 10.1016/j.ajog.2019.10.104.
75. Wright JD, Burke WM, Wilde ET, Lewin SN, Charles AS, Kim JH, et al. Comparative effectiveness of robotic versus laparoscopic hysterectomy for endometrial cancer. J Clin Oncol. 2012;30(8):783-91. doi: 10.1200/JCO.2011.36.7508.
76. Gagner M, Garcia-Ruiz A. Technical aspects of minimally invasive abdominal surgery performed with needlescopic instruments. Surg Laparosc Endosc. 1998;8(3):171-9.
77. Gueli Alletti S, Vizzielli G, Lafuenti L, Costantini B, Fagotti A, Fedele C, et al. Single-Institution Propensity-Matched Study to Evaluate the Psychological Effect of Minimally Invasive Interval Debulking Surgery Versus Standard Laparotomic Treatment: From Body to Mind and Back. J Minim Invasive Gynecol. 2018;25(5):816-22. doi: 10.1016/j.jmig.2017.12.007.
78. Lee C-L, Liu H-M, Khan S, Lee P-S, Huang K-G, Yen C-F. Vaginal natural orifice transvaginal endoscopic surgery (vNOTES) surgical staging for endometrial carcinoma: The feasibility of an innovative approach. Taiwan J Obstet Gynecol. 2022;61(2):345-52. doi: 10.1016/j.tjog.2022.02.026.
79. Donnez O, Donnez J, Dolmans M-M, Dethy A, Baeyens M, Mitchell J. Low Pain Score After Total Laparoscopic Hysterectomy and Same-Day Discharge Within Less Than 5 Hours: Results of a Prospective Observational Study. J Minim Invasive Gynecol. 2015;22(7):1293-9. doi: 10.1016/j.jmig.2015.06.021.
80. Nam EJ, Kim SW, Kim S, Kim JH, Jung YW, Paek JH, et al. A case-control study of robotic radical hysterectomy and pelvic lymphadenectomy using 3 robotic arms compared with abdominal radical hysterectomy in cervical cancer. Int J Gynecol Cancer. 2010;20(7):1284-9. doi: 10.1111/IGC.0b013e3181ef0a14.
81. Abi Antoun M, Etrusco A, Chiantera V, Laganà AS, Feghali E, Khazzaka A, et al. Outcomes of conventional and advanced energy devices in laparoscopic surgery: a systematic review. Minim Invasive Ther Allied Technol. 2024;33(1):1-12. doi: 10.1080/13645706.2023.2274396.
82. Ramadan A, Etrusco A, D'Amato A, Laganà AS, Chiantera V, Zgheib C, et al. Evaluation of the benefit of indocyanine green as an educational and practical tool for ureteral identification in laparoscopic pelvic surgery: a cross-sectional study. Min Inv Ther Allied Tech. 2024;33(5):302-10. doi: 10.1080/13645706.2024.2376837.
83. Puntambekar S, Rajamanickam S, Agarwal G, Joshi S, Rayate N, Deshmukh A. Laparoscopic posterior exenteration in advanced gynecologic malignant disease. J Minim Invasive Gynecol. 2011;18(1):59-63. doi: 10.1016/j.jmig.2010.09.003.
84. Elmaasrawy A, Abd-Almohsen Alnemr A, Elfeky AA, Harb OA, Elsayed Abdel-Razik AR. Single-port laparoscopy versus conventional laparoscopy for management of benign adnexal masses during pregnancy: a comparative study. Ital J Gynaecol Obstet. 2024;36(2):226-31. doi: 10.36129/jog.2023.128.
85. Elmaasrawy A, Barakat M, Wasfy MA, Negm M, Mahmoud Almeniawy M, Gertallah LM, Elfeky MA, et al. Transvaginal versus transumbilical laparoscopic single-site surgery for management of benign adnexal masses: a comparative study. Ital J Gynaecol Obstet. 2024;36(3):333-9. doi: 10.36129/jog.2023.145.