Provisionally accepted for publication

NARRATIVE REVIEW

Perioperative management of oncological gynaecological robotic surgery patients (application of the ERAS protocol): a narrative literature review

ERAS protocol in gynecological robotic surgery

Chiara **Giammaria** [1], Doriana **Madeo** [2], Alessandro **Spano** [1,*], Emilia **Spagnolo** [1], Matteo **Necci** [1], Fabio **Pannuccio** [3], Fabrizio **Petrone** [1]

[1] Nursing, Technical, Rehabilitation, Assistance and Research Direction – IRCCS Istituti Fisioterapici Ospitalieri – IFO, Rome, Italy.

[2] Città d'Europa Pharmacy, Rome, Italy.

[3] Department of Emergency, Papardo Hospital, Messina, Italy.

***Corresponding author:** Alessandro **Spano** Dr. Nursing, Technical, Rehabilitation, Assistance and Research Direction IRCCS Istituti Fisioterapici Ospitalieri – IFO, via Elio Chianesi, 53, 00144 Rome, Italy.

Email: alessandro.spano@ifo.it.

ORCID: 0000-0002-5097-4693.

Doi: 10.36129/jog.2024.187

ABSTRACT

Objective. The primary objective of this narrative review is to provide an overview of the status of perioperative management of patients undergoing robotic gynaecological surgery and the implementation of the Enhanced Recovery After Surgery (ERAS) protocol.

Materials and Methods. The narrative literature was conducted through medical databases such as PubMed, Scopus and Web of Science. Articles and studies relevant to the keywords were retrieved. Descriptive methods were used to summarise and interpret data from the various included studies.

Results. Robotic gynaecological surgery offers numerous advantages, including shorter hospital stays, lower postoperative complication rates, and improved aesthetic outcomes. The use of the ERAS protocol has further demonstrated improved patient management and postoperative outcomes.

Conclusions. Robotic surgery combined with the ERAS protocol significantly improves the surgical management of gynaecological pathologies. However, it is crucial to balance the potential benefits with the associated challenges and risks to ensure safety and efficacy for patients.

Key words

Robotic Surgical Procedures; ERAS protocol; Gynaecological oncology surgery

Legend

ERAS: Enhanced Recovery After Surgery Protocol

NPO: Fasting since midnight

TAP: Transversus abdominis plane

TEA: Thoracic epidural analgesia

TEV: Venous Thromboembolism

MIS: Minimally invasive surgery

Introduction

In countries with high socio-economic development, gynaecological cancers are one of the most common neoplastic diseases in women and a major cause of cancer-related mortality in women [1-4]. Gynaecological surgery has undergone significant changes in recent decades due to technological evolution, leading to the emergence of robotic surgery as an increasingly adopted interventional modality [5,6]. **Several studies have documented the benefits of robotic gynaecological surgery, highlighting significant reductions in post-operative complications, shorter hospital stays and improved surgical aesthetics [5,7]**. Similarly, the literature highlights how the use of the ERAS protocol can contribute to optimised pain management, reduced length of hospital stay and accelerated functional recovery [8,9]. At the same time, the introduction and adoption of the Enhanced Recovery After Surgery (ERAS) protocol has revolutionised the perioperative management of patients with the aim of reducing postoperative morbidity and accelerating patient recovery. Despite the emerging evidence, there is a growing need to understand both the benefits and potential limitations associated with these innovations. This increased clinical adoption has raised questions about training, accessibility, cost and long-term patient outcomes [5]. Therefore, the primary aim was to provide evidence-based evidence to inform clinical decisions and health policy, and to improve public understanding of the technologies and protocols under discussion.

Materials and Methods

This narrative literature review used a focused methodology to identify, select and synthesise relevant articles on robotic gynaecological surgery and the use of the ERAS protocol. The search was conducted using medical databases, including PubMed, Scopus and Web of Science. Articles and studies relevant to the keywords robotic surgery, ERAS protocol, gynaecological oncological surgery in English, Italian and Spanish were included. Articles not relevant to the topics of interest, including some keywords, but irrelevant to robotic gynaecological surgery were excluded. **Inclusion criteria were: (1) articles in English - Italian - Spanish, (2) studies focusing on gynaecological robotic surgery, (3) studies focusing on traditional- robotic- laparoscopic gynaecological**

surgery in patients in whom the ERAS protocol was applied, (4) studies analysing the results of the application of the ERAS protocol in gynaecology and others (5) studies related to the ERAS guidelines.

The exclusion criteria were: (1) non-exhaustive articles, (2) studies not related to the topic of interest, (3) articles reporting surgical outcomes but not related to the ERAS protocol.

No time limits were set. Due to the narrative nature of this review, statistical analyses were not performed. However, descriptive methods were used to summarise and interpret the data from the different included studies. Findings and considerations from the studies were interpreted in terms of their direct impact on quality of care and patient experience.

Results

The care pathway for patients undergoing robotic gynaecological surgery is a multifaceted process that requires optimised phased management to ensure positive outcomes [5,6,9,11,15]. The literature review highlighted several critical phases in the patient's surgical pathway, each with specific challenges and considerations.

Discussion

- *Pre-admission Phase*

During this phase, preoperative preparation and patient assessment are paramount. The ERAS protocol emphasises the importance of detailed preoperative assessment (nutritional status, presence of anaemia, smoking cessation and cessation of alcohol intake four weeks prior [3], optimisation of chronic disease therapy, thromboembolic prophylaxis) and effective patient education regarding expectations and postoperative pathways [6,10,11].

- *Preoperative Phase*

Fasting since midnight has been arbitrarily imposed to prevent aspiration of gastric contents during anaesthesia. However, prolonged fasting (nothing by mouth NPO) has been shown to place the patient in a state of metabolic stress [8,11]. The American Society of Anesthesiology recommends NPO with light meals for at least 6 hours and no clear fluid intake for at least 2 hours prior to elective

surgery requiring general or regional anaesthesia or sedation/analgesia [11,12]. In addition, the ERAS pathway supports preoperative consumption of high-carbohydrate beverages (2 hours before surgery) to reduce preoperative caloric restriction, improve insulin resistance and enhance the body's postoperative response [11].

Several studies have demonstrated various benefits associated with robotic surgery for endometrial cancer; operative time ($p = 0.007$), estimated blood loss ($p < 0.001$), post-anaesthesia care unit stay ($p < 0.001$), length of hospital stay ($p < 0.001$); intravenous fluids (crystalloid and colloid; $p < 0.001$); incidence of post-operative nausea and vomiting and need for rescue antiemetics ($p < 0.001$) [13,14]. Despite the lower incidence of postoperative antiemetic requirements with robotic surgery for endometrial cancer compared with the same procedure using an open approach, the ERAS protocol recommends prophylaxis for postoperative nausea and vomiting as a general preoperative guideline for gynaecological/oncological patients [10-15].

Routine use of mechanical bowel preparation before minimally invasive gynaecological surgery (MIS) has not been shown to improve intraoperative visualisation, bowel management or ease of procedure [11]. Pre-operative anxiolytic medication is widely used in gynaecological surgery to reduce anxiety; however, this practice is not strongly recommended [11]. Recommended antibiotic prophylaxis includes administration of antibiotics 60 minutes prior to skin incision, with possible intra- or post-operative repeat courses [11].

- *Intraoperative Phase*

MIS, like robotic surgery, is recommended by the ERAS protocol for selected patients when skills and resources are available [11]. During robotic surgery, accurate control of various parameters is essential to ensure safety and efficacy. The ERAS protocol places particular emphasis on the continuous monitoring of patient vital signs, the maintenance of normothermia, the control of drainage and the management of fluids in order to maintain homeostasis [11]. It should be noted that intraoperative nasogastric tube placement is usually removed before the patient awakens [11]. The management of patients undergoing robotic surgery with the implementation of ERAS pathways requires a synergistic team approach where the surgeon, anaesthetist and theatre nurses are at the centre of a care process focused on proper preparation of the surgical environment and patient

safety throughout the intraoperative period [16]. Managing the room layout, connecting the surgical console to the patient side-cart, turning on the vision cart, preparing the surgical instruments, positioning the patient correctly, managing potential robotic system errors and intraoperative complications are just some of the many tasks that must be ensured for the success of the procedure [17,18]. Technical aspects of patient ventilation are not addressed in this section.

- *Immediate Postoperative Phase*

Following surgical intervention, the subsequent awakening and stabilisation phase is of paramount importance to prevent complications and facilitate a rapid recovery. The Enhanced Recovery After Surgery (ERAS) protocol places significant emphasis on the importance of frequent patient monitoring, with particular attention paid to the identification of postoperative complications. **The protocol recommends a multimodal approach to pain management, glycaemic monitoring and regular assessment of drains, tubes and urinary catheters (removed within the first 24 postoperative hours) to ensure optimal drainage and functionality [15].** TEA (thoracic epidural analgesia) is not recommended for gynaecological/oncological endoscopic procedures [15]. A truncal block, such as a transversus abdominis plane (TAP) block, may reduce pain and opioid consumption [15].

Infiltration of the MIS access site with local anaesthetic is recommended to reduce pain [19]. Additionally, it is advised that the level of peritoneal insufflation pressure be maintained at a relatively low level. This approach should be accompanied by careful consideration of the potential reduction in visualisation of the intra-abdominal surgical space [19]. Multimodal analgesia consists of a combination of several analgesics, combining the mechanisms of action of each drug to achieve a better and synergistic effect of analgesics and to minimise their dose and side effects [20].

Non-steroidal anti-inflammatory drugs reduce pain and the intestinal inflammatory response to surgical trauma, which is the cause of mobility problems [20]. Studies show that the use of the ERAS protocol in MIS surgery reduces postoperative pain [21]. The prophylactic use of non-steroidal anti-inflammatory drugs, as suggested by the ERAS protocol, reduces pain and does not affect gastrointestinal motility, contributing to faster recovery [20]. Although

non-steroidal anti-inflammatory drugs or COX-2 inhibitors are often suggested, a combination of 2 or more drugs is recommended for postoperative pain management [19]. Dexamethasone can also be used to reduce postoperative nausea and pain. Ketorolac, Ketamine, Paracetamol, Gabapentin or Tramadol are often used as alternatives to opioids. However, the possible respiratory side effects of Gabapentin and the neuropsychiatric side effects of Ketamine should be noted [19].

Compression stockings, heparin administration or possibly prolonged thromboembolic prophylaxis in gynaecological oncology patients are essential to reduce the incidence of TEV (venous thromboembolism) [15]. However, prolonged prophylaxis is not usually required in MIS patients (except in high-risk patients with increased BMI, previous TEV, coagulopathy, reduced mobility) [15]. Nutritional reintroduction within the first 24 postoperative hours is necessary for proper recovery of intestinal peristalsis and patient comfort and satisfaction [15]. In order to optimise postoperative recovery, the administration of long-acting sedatives within 12 hours of surgical intervention should be avoided [11].

- *Discharge and Post-discharge Phase*

On discharge, it is important to ensure that the patient is adequately educated about the signs and symptoms of postoperative complications and how to manage them. **Post-discharge opioid prescribing could be reduced by multimodal pain management [22]. Patient-controlled analgesia (PCA) should only be used as a last resource when repeat opioid treatment is required [22].** Regular follow-up visits are scheduled to monitor recovery, manage any complications, and evaluate the effectiveness of the surgical pathway [11].

The following is the Enhanced Recovery After Surgery (ERAS) flowchart for patients undergoing robotic gynaecologic surgery. It was created based on recommendations from the literature (Figure 1).

Conclusions

Surgical and biotechnological advances have made robotic surgery feasible, safe and reproducible, making it an acceptable substitute for laparoscopy in the treatment of obese women with endometrial cancer [23]. In addition, a robotic approach should be considered for the treatment of recurrent gynaecological tumours in selected patients with oligometastatic disease. **Furthermore, robotic surgery may play an important role in the future treatment of solid tumours. Its integration into the conceptual framework of translational medicine may facilitate the emergence of a new era of personalised medicine [7].** The primary benefits associated with gynaecological robotic surgery include a significant reduction in post-operative pain, lower rates of intra- and post-operative complications, reduced length of hospital stay and improved aesthetic outcomes [5,24]. At the same time, the introduction and widespread adoption of the Enhanced Recovery After Surgery (ERAS) protocol has marked a further advance in perioperative management, emphasising improved pain management, reduced length of hospital stay and accelerated postoperative recovery [8-12]. **An interesting study was recently conducted to assess physical functioning, bodily pain, general health, vitality, social functioning, emotional and mental health in women undergoing hysterectomy and lymph node staging before and after implementation of the ERAS protocol [25]. After analysing the results, it was concluded that ERAS is an excellent tool for improving health-related quality of life (HRQL) in this patient population [25].**

In conclusion, as robotic gynaecologic surgery continues to set new benchmarks of excellence in clinical practice, it is imperative to recognise the importance of integrated implementation of the ERAS protocol to maximise clinical benefits and improve the overall surgical experience for patients. The intersection of these two innovations represents an evolutionary paradigm shift in gynaecological surgery, which promises a future in which safety, efficacy and quality of care will reach very high levels. As a result of the continuing interest in gynaecological cancer patients in Italy [26-28], further future studies are needed to investigate the applicability and benefits of using the ERAS protocol in Italian patients undergoing robotic gynaecological surgery. Therefore, continued investment in training, research and implementation of best practices is essential to guide this

surgical revolution and ensure optimal outcomes for all patients undergoing robotic gynaecological surgery.

Future perspectives and limitations

The objective of this narrative review of the literature is to emphasise the significance of utilising the ERAS protocol and the advantages that can be derived for patients with gynaecological tumours undergoing robotic surgery. There is a growing interest in the use of ERAS guidelines, but they are not yet fully applied. By reviewing and analysing the different areas, the authors hope to contribute to the implementation of ERAS best practice. In the future, further studies can be conducted to investigate the benefits of using the ERAS protocol in patients with gynaecological tumours undergoing multi-port and single-port robotic surgery.

This is not a systematic review of the literature; some relevant studies may have been excluded due to methodological selection bias. The anaesthesiological aspects of the management of patients with gynaecological tumours, during robotic surgical procedures, have not been adequately explored, as this is a widely discussed topic that deserves a specific and dedicated review.

Compliance with Ethical Standards

Authors contribution: C.G. Writing – original draft and conceptualization, D.M. Writing – original draft, A.S. Writing – review & editing, E.S. Conceptualization, M.N. Visualization, F.P. Supervision

Funding: No funding was received to assist with the preparation of this manuscript.

Study registration: Not applicable.

Disclosure of Interests: Authors declare no conflict of interests exists.

Ethical Approval: Not applicable.

Informed consent: Not applicable.

Data sharing: *July 2024*

References

1. **Ferrari F, Giannini A. Approaches to prevention of gynecological malignancies. BMC Womens Health. 2024;24(1):254. doi: 10.1186/s12905-024-03100-4.**
2. **Vitale SG, Angioni S, D'Alterio MN, Ronsini C, Saponara S, De Franciscis P, Riemma G. Risk of endometrial malignancy in women treated for breast cancer: the BLUSH prediction model - evidence from a comprehensive multicentric retrospective cohort study. Climacteric. 2024;1-7. doi: 10.1080/13697137.2024.2376189.**
3. **Cuccu I, Sgamba L, Cannicchio A, De Angelis E, Golia D'Augè T, Di Bartolomeo G, Dio C, Firulli I, Trezza A, Azenkoud I, Muzii L. Evolution of retroperitoneal staging in endometrial cancer: narrative review and overview of literature. Ital J Gynaecol Obstet. 2023; 35. doi:10.36129/jog.2023.105.**
4. **Serva A, Tiberi A, Palermo P, D'Alfonso A, Ludovisi M, Rosario G, Stefano N, Serva D, De Dominicis A, Guido M, Stefano LM. Synchronous ovarian and uterine tumours, case report of an unusual association. Ital J Gynaecol Obstet. 2024. doi:10.36129/jog.2024.156.**
5. Alkatout I, Mettler L, Maass N, Ackermann J. Robotic surgery in gynecology. J Turk Ger Gynecol Assoc. 2016;17(4):224–32. doi: 10.5152/jtgga.2016.16187.
6. Boggess JF. Robotic surgery in gynecologic oncology: evolution of a new surgical paradigm. J Robot Surg. 2007;1(1):31-7. doi: 10.1007/s11701-007-0011-4.
7. **Certelli C, Palmieri L, Federico A, Oliva R, Conte C, Rosati A, Vargiu V, Tortorella L, Chiantera V, Foschi N, Ardito F, Lodoli C, Bruno M, Santullo F, De Rose AM, Fagotti A, Fanfani F, Scambia G, Gallotta V. Robotic approach for the treatment of gynecological cancers recurrences: A ten-year single-institution experience. Eur J Surg Oncol. 2024; 50(9):108526. doi: 10.1016/j.ejso.2024.108526.**
8. Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: A Review. JAMA Surg. 2017;152(3):292-298. doi: 10.1001/jamasurg.2016.4952.
9. Paek J, Lim PC. Enhanced Recovery after Surgery (ERAS) Protocol for Early Discharge within 12 Hours after Robotic Radical Hysterectomy. J Clin Med. 2022;11(4):1122. doi:

10.3390/jcm11041122.

10. Fernandez S, Trombert-Paviot B, Raia-Barjat T, Chauleur C. Impact of Enhanced Recovery After Surgery (ERAS) program in gynecologic oncology and patient satisfaction. J Gynecol Obstet Hum Reprod. 2023;52(2):102528. doi: 10.1016/j.jogoh.2022.102528.
11. Nelson G, Altman AD, Nick A, Meyer LA, Ramirez PT, Achtari C, et al. Guidelines for pre- and intra-operative care in gynecologic/oncology surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations--Part I. Gynecol Oncol. 2016;140(2):313-22. doi: 10.1016/j.ygyno.2015.11.015.
12. Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures: An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. Anesthesiology. 2017;126(3):376-393. doi: 10.1097/ALN.0000000000001452.
13. Sinno AK, Fader AN. Robotic-assisted surgery in gynecologic oncology. Fertil Steril. 2014;102(4):922-32. doi: 10.1016/j.fertnstert.2014.08.020.
14. Agarwal R, Rajanbabu A, Unnikrishnan UG. A retrospective evaluation of the perioperative drug use and comparison of its cost in robotic vs open surgery for endometrial cancer. J Robot Surg. 2018;12(4):665-672. doi: 10.1007/s11701-018-0799-0.
15. Nelson G, Altman AD, Nick A, Meyer LA, Ramirez PT, Achtari C, et al. Guidelines for postoperative care in gynecologic/oncology surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations--Part II. Gynecol Oncol. 2016;140(2):323-32. doi: 10.1016/j.ygyno.2015.12.019.
16. Kalogera E, Dowdy SC. Enhanced Recovery Pathway in Gynecologic Surgery: Improving Outcomes Through Evidence-Based Medicine. Obstet Gynecol Clin North Am. 2016;43(3):551-73. doi: 10.1016/j.ogc.2016.04.006.
17. Tabor W. On the cutting edge of robotic surgery. Nursing. 2007;37(2):48-50. doi: 10.1097/00152193-200702000-00037.

18. Lichosik D, Arnaboldi C, Astolfi D, Caruso R, Granata M. Nurses' role in robotic surgery. EONS. 2014; 1:22–4. No doi.
19. Lönnerfors C, Persson J. Can robotic-assisted surgery support enhanced recovery programs? Best Pract Res Clin Obstet Gynaecol. 2023; 90:102366. doi: 10.1016/j.bpobgyn.2023.102366.
20. Slavchev S, Yordanov A. Enhanced Recovery After Surgery (ERAS) protocol in minimally invasive gynecological surgery: a review of the literature. Pol Przegl Chir. 2022; 95(3):1-5. doi: 10.5604/01.3001.0015.8687.
21. Carter J. Enhanced recovery in gynecologic surgery. Obstet Gynecol. 2013;122(6):1305. doi: 10.1097/AOG.0000000000000033.
22. Nelson G, Fotopoulou C, Taylor J, Glaser G, Bakkum-Gamez J, Meyer LA, Stone R, Mena G, Elias KM, Altman AD, Bisch SP, Ramirez PT, Dowdy SC. Enhanced recovery after surgery (ERAS®) society guidelines for gynecologic oncology: Addressing implementation challenges - 2023 update. Gynecol Oncol. 2023;173:58-67. doi: 10.1016/j.ygyno.2023.04.009.
23. Golia D'Augè T, Cuccu I, De Angelis E, Buzzaccarini G, D'Oria O, Besharat A, Caserta D, Muzii L, Bogani G, Di Donato V, Giannini A. Robotic vs. laparoscopic approach in obese patients with endometrial cancer: which is the best? A mini-review. *Oncologie*. 2024;26(1): 59-64. https://doi.org/10.1515/oncologie-2023-0437.
24. Vizza E, Chiofalo B, Cutillo G, Mancini E, Baiocco E, Zampa A, Bufalo A, Corrado G. Isterectomia radicale robotica a sito singolo più linfadenectomia pelvica nei tumori ginecologici. J Gynecol Oncol. 2018;29(1):e2. doi: 10.3802/jgo.2018.29.e2.
25. Ferrari F, Soleymani Majd H, Giannini A, Favilli A, Laganà AS, Gozzini E, Odicino F. Health-Related Quality of Life after Hysterectomy for Endometrial Cancer: The Impact of Enhanced Recovery after Surgery Shifting Paradigm. Gynecol Obstet Invest. 2024;89(4):304-310. doi: 10.1159/000538024.
26. Cucinella G, Zammarrelli W, Nasioudis D, Capasso I, Berretta R, Scollo P, et al. #534 Prognosis of surgically staged FIGO IA uterine carcinosarcoma without myometrial invasion:

a multicenter international retrospective cohort study. Int J Gynecol Cancer. 2023; 33. doi: 10.1136/ijgc-2023-ESGO.342.

27. 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. Int J Environ Res Public Health. 2022;19(20):13176. doi: 10.3390/ijerph192013176.
28. Mereu L, Pecorino B, Ferrara M, Siniscalchi M, Garraffa G, D'Agate MG, et al. Cumulative Sum Analysis of Learning Curve Process for Vaginal Natural Orifice Transluminal Endoscopic Surgery Hysterectomy. J Minim Invasive Gynecol. 2023;30(7):582-586. doi: 10.1016/j.jmig.2023.03.013.

Figure 1. Enhanced Recovery After Surgery (ERAS) Flowchart Enhanced Recovery After Surgery (ERAS) Flowchart for patients undergoing gynecological robotic surgery.