RESEARCH ARTICLE

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Outcomes of Enhanced Recovery after Surgery (ERAS) in Gynaecologic Oncology: A Randomized Clinical Trial

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Abstract

Objective: ERAS protocols in major gynaecologic oncology surgery (MGOS), have established effectiveness in reducing complications, Length of Stay (LOS), and hospital costs. Their implementation appears to improve patient care compared to conventional perioperative practice. This study assessed the efficacy of ERAS protocol versus conventional postoperative care in the recovery of patients undergoing major gynaecological oncology surgery (MGOS). **Methods:** A prospective, randomized, single-centre study. A sample size of convenience included 101 patients with gynaecological cancer who underwent MGOS. Patients randomized into two groups: in group A (n=51, 50.5%), patients allocated to the ERAS protocol, and in group B (n=50, 49.5%), patients followed conventional care. **Results:** The mean age in group A was 52.8 years and in group B 56.7 years ($p = 0.1$). In the ERAS group the LOS was significantly lower compared to the control group, mean 3.9 versus 5.9 days ($p < 0.001$). All indicators of recovery, such as mobilisation, feeding, bowel motility , discontinuation of intravenous (IV) administration, catheter and drainage removal in the first 24 hours, were significantly improved in patients in the ERAS group. Furthermore complications in patients in the ERAS group, such as fever, urinary tract infection, and perioperative bleeding, were also significantly lower. **Conclusion:** Within the limitations of a small single centre RCT, ERAS protocol in MGOS appeared to promote early enteral feeding, discontinuation of IV fluids, early gastrointestinal motility , faster removal of drainage and bladder catheter, faster patient standing and mobilisation, fewer requirements for blood transfusion, lower rate of drowsiness and sedation and episodes postoperative fever and leukocytosis.

Keywords: ERAS programmes- ERAS protocol- major gynaecologic oncology surgery- postoperative recovery

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Introduction

ERAS programmes consist of specific approaches in three phases: preoperative, intraoperative and postoperative [1, 2]. The preoperative phase includes patient education and counselling, optimization of preoperative medical conditions and, minimizing the preoperative fasting period with carbohydrate intake [3]. The intraoperative phase includes any minimally invasive surgical technique where possible, the use of multimodal analgesia to reduce opioid use, prevention of hypothermia and, maintenance of euvolemia [4]. The postoperative phase includes effective pain management by avoiding reliance on opioids, early initiation of oral intake and encouragement of early mobilization and physical activity [4, 5].

The implementation of ERAS programs in major gynaecologic oncology surgery (MGOS) is transformative. It not only enhances the recovery process by reducing the length of stay (LOS) and improving gastrointestinal function but also reduces the rates of postoperative complications, transfusions, and readmissions [6, 7]. These benefits contribute to better patient satisfaction and cost-effective healthcare delivery.

The purpose of this study was to compare the efficacy of the Enhanced Recovery After Surgery (ERAS) protocol versus the conventional postoperative care in the recovery of patients undergoing MGOS for cancer of the internal genitalia. This research was the first part of a doctoral thesis.

The study aimed to achieve this comparison by focusing on three main objectives. First, it evaluated the gastrointestinal (GIS) function in postoperative patients, including aspects such as feeding, nausea, vomiting, and

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intestinal excretion. Secondly, it assessed the incidence of postoperative complications, including bleeding, thrombosis, fever, and inflammation. Finally, the study documented hospital readmissions occurring within 30 days of discharge.

Materials and Methods

This is a prospective, randomized, single-centre study. The sample includes patients with internal genital cancer who underwent MGOS and were randomized into two equal groups: group A, which followed the ERAS protocol, and group B, which followed conventional care.

Statistical analysis: Numbers and percentages were used to present categorical variables. Moreover, mean, standard deviation (SD), median, and range were employed to present continuous variables. The Kolmogorov-Smirnov test was applied to examine the distribution of continuous variables. The chi-square test was utilized to compare nominal variables, and the chi-square trend test was used to compare nominal with ordinal variables. Moreover, when the continuous variables followed normal distribution, the independent samples t-test was employed to explore differences between two groups, whereas the Mann-Whitney test was used in case of non-normal distribution. Since the two groups were similar, regarding demographic and clinical variables, there was no need for multivariable analysis. P-values < 0.05 were considered statistically significant. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 21.0. (Armonk, NY: IBM Corp.).

There was no statistically significant difference between demographic characteristics, diagnosis, surgery, medical history and laboratory testing in the two groups (ERAS and Conventional Recovery), so randomisation ensured the absence of confounders. Therefore, it was not necessary to carry out multivariate analyses to investigate the efficacy of ERAS.

The collection of medical parameters includes data from anaesthesia charts, surgery report, personal medical file and individual patient interviews. The inclusion criteria for this study required participants to be Greek language speakers with full mental clarity and aged over 18 years. Patients were excluded if they were undergoing treatment for chronic pain or antidepressants, had acute or chronic renal or liver disease, or experienced chronic mobility problems.

Participation in the study and completion of questionnaires was voluntary and anonymous. There was no risk to patient safety and the health care they received was not affected.

Description of the ERAS Protocol

The programme started the day before the scheduled operation with the patient being informed about the protocol to be followed in the ERAS group, the surgical technique, the treatment care plan. At the same time, the therapeutic goals were set and any questions were explained [3]. Patients in the conventional group received no further instructions.

The night before surgery, patients in both groups received a laxative enema followed by a cleaning bath with mild skin soapy antiseptic [8, 9]. Graduated compression elastic stockings were applied on and prophylactic thromboprophylaxis with 20-40 mg of Low Molecular Weight Heparin (LMWH) was administered based on the cardiologist's instructions [10].

Patients in the ERAS group received light solid food for up to 6 hours and 200 ml of clear or carbohydrate-rich liquids up to 4 hours before the scheduled time of surgery [4, 11]. Carbohydrate solutions of 200 ml up to 4 hours or 50 ml up to 2 hours prior to induction of anaesthesia were allowed, unless there was a medical clinical contraindication. In contrast, control group patients had to fast from the afternoon and Nil Per Os (NPO) from midnight, while to prevent possible dehydration they received 1 L R/L until the morning of surgery.

The morning before surgery, patients in both groups received an additional laxative enema, followed again by an antiseptic cleaning bath [8]. Prophylactic intravenous (IV) antibiotic treatment with first-generation cephalosporin or ciprofloxacin for allergic patients was then administered within 30-60 minutes before the surgical incision [12].

After each patient entered the operating room and was identified, baseline monitoring ensued, which included continuous ECG recording, non-invasive blood pressure measurement, and pulse oximetry [13]. A peripheral venous line with a 16G-20G catheter was then placed and the patients were preoxygenated [14]. Intraoperatively, a common standardised anaesthetic protocol was followed in order to obtain comparable results for all participants.

Analgesic treatment was started early after induction to anaesthesia. Throughout the procedure, homeostasis (normoglycaemia and normal blood volume) and diuresis were evaluated in patients of both groups [4]. In addition, in ERAS group patients body temperature was continuously measured and maintained up to 36oC, using devices to warm IV fluids (serum, blood and derivatives) to 41oC and external body warm air devices [4].

After completion of the procedure, neuromuscular blockade was reversed by sugammadex (2 mg/kg) administered to both groups [4, 15]. After tracheal extubation and awakening, patients were transferred to post anaesthesia care unit (PACU), where they remained for approximately one hour. After they were transferred back to the Wards, patients in the ERAS group continued the analgesic and antiemetic protocol, which was started intraoperatively. Similarly, monitoring of homeostasis (glucose with dextrostick, electrolytes and haematocrit/haemoglobin by blood test) and renal function (diuresis > 30 ml/h) was continued. Patients in the ERAS group were given a 3-flow spirometer to initiate respiratory physiotherapy.

Patients in the ERAS group began food intake 4-6 hours after surgery, provided they did not vomit, with clear fluids (water, tea, chamomile, apple juice, carbohydrate drinks, filter coffee) and jelly. As they received sufficient PO fluids, parenteral administration was discontinued [4]. In contrast, control group patients continued fasting PO, receiving 2-3 L/24h of IV fluids.

ERAS group patients were mobilised based on a

schedule, within 4-6 hours of surgery, initially in their beds and then in their chairs, while control group patients were mobilised at will [16]. From postoperative day 1 (POD-1), patients in the ERAS group were fed a light hyperalbumin diet and their IV analgesic treatment was converted to PO [17, 18]. In contrast, control group patients received a diet of liquids, soup and jelly, provided they had normal bowel sounds and movements, and their analgesic medication continued as it was.

In ERAS group patients, the urinary catheter and drains were removed (except when clinically contraindicated), and patients gradually regained their full mobility. The goal of mobilisation was to walk the Ward corridor more than 4 times in 8 hours [16]. Bowel motility was assessed and, where necessary, mild bowel motility stimulants (coffee and senna leaf tea) were administered [19]. In contrast, patients in the control group stood up and mobilised at will. From POD-2, ERAS group patients could consume a full hyperalbumin diet (upon contraindication they followed a light diet), were fully mobilised in the hospital premises, and bowel functionality was tested. However, control group patients could eat a light diet, as long as there was intestinal motility. If indicated, they received laxatives to mobilise the digestive system, and, if there was no clinical indication, the urinary catheter and wound drains were removed [17].

ERAS group patients were able to be discharged and continue their recovery at home, from POD-2, provided that the pre-specific discharge criteria were met. On the other hand, control group patients could be discharged from POD-3 onwards provided they met the discharge criteria. The above-mentioned interventions and discharge criteria are comparatively reflected for both groups in Table 1.

Table 1. ERAS Interventions and Discharge Criteria

	ERAS Recovery Protocol	Conventional/Standard Postoperative Care
Day before surgery	Patient information for the ERAS programme Informed consent	Informed consent
	SSurgical plan – Goal setting – Participation of the patient	No further information was given
	Bowel preparation with enema	
	Thromboprophylaxis with LMWH 20-40 mg SC	
	Cleaning bath with mild soapy skin antiseptic	Cleaning bath
	Hydric clear food up to 2-4 hours and food up to 6 hours before surgery. Carbohydrate solutions of 200 ml up to 4 hours or 50 ml up to 2 hours before the surgery are allowed.	No PO as of 8:00 p.m., no water after 12:00 a.m. Start of 1000 ml Ringer's lactate IV
In the morning before surgery	Bowel preparation with enema	
	Cleaning bath with mild soapy skin antiseptic	Cleaning bath
Intraoperatively	Standard anaesthesiology protocol	
	Normal blood volume	No specific treatment plan was followed
	Normal temperature	
	Normoglycaemia	
	Analgesia	
	Nausea - vomiting protocol	Ondansetron 4 mg Metoclopramide 10-20 mg on indications
Day 0 (surgery)	Analgesia	
	Nausea - vomiting protocol	On nausea ondansetron 4 mg × 2 Metoclopramide 10-20 mg on indications
	Parenteral fluid administration until oral fluid intake	Parenteral fluid administration 2-3 L/24h
	Liquids PO 4-6 h post-op Liquid diet* and jelly *water, tea, chamomile, filter coffee, apple juice, carbohydrate drinks	No specific treatment plan was followed
	Mobilisation – Standing 4-6 h post-op	Standing at will
	Diuresis monitoring >30 ml/h	Diuresis monitoring >500 ml/8h
	3-flow spirometer	No spirometer
Day 1	Analgesia	
	Thromboprophylaxis	
	3-flow spirometer	No spirometer
	Fully standing	Standing at will
	Diuresis monitoring – Removal of urinary catheter	Diuresis monitoring
	Evaluation of bowel function. Mild bowel motility stimulants	Bowel function testing
	Diet 1: Light hyperalbumin	Diet: liquid, soup and jelly

Table 1. Continued

	ERAS Recovery Protocol	Conventional/Standard Postoperative Care
Day 1	Cleaning bath	
	Drain removal	No drain removal
Day 2 and 3	Analgesia	
	Free diet Full mobilisation 3-flow spirometer	Light diet 1 Mobilisation No spirometer
	Thromboprophylaxis	
	Diuresis	Diuresis – Removal of urinary catheter
	Bowel function testing	Bowel function testing and administration of laxatives upon indications Drain removal
Discharge criteria	Free diet	
	Full mobilisation	
	Full motility of the digestive system	
	Help at home	
	Satisfactory analgesia	
	Understanding discharge instructions - education	
	Removal of urinary catheter and drains	
Instructions upon discharge	Thromboprophylaxis	
	Analgesia	
	Telephone communication for 3 days and reassessment at POD7 or POD15	Reassessment at POD15

Results

The population included 101 women undergoing gynaecological oncology surgery. 51 (50.5%) were randomized to the ERAS group and 50 (49.5%) to the control group. The mean age in the ERAS group was 52.8 years, and 56.7 years (p = 0.1) in the control group. The mean body mass index (BMI) in the ERAS group was 26.4 kg/m^2 and 26.8 kg/m^2 (p = 0.7) in the control group.

There was no statistically significant difference in demographic characteristics, diagnosis, surgery, personal history and laboratory testing prior to surgery between the two groups (Table 2, 3 and 4), so it was possible to obtain comparable results between the two groups.

In the ERAS group, the number of hospitalisation days was statistically significantly lower compared to the control group (p < 0.001). More specifically, the mean number of days of hospitalisation in the control group was 5.9, while in the ERAS group it was 3.8 (Table 5).

In women in the ERAS group, the rate of getting up in a chair and the rate of full mobilisation within 18 hours was statistically significantly higher than in the control group (p < 0.001). Specifically, the rate of getting up (within 18 hours) in a chair in the control group was 10.2%, while in the ERAS group it was 93.9% and, the rate of full mobilisation in the control group was 18.4%,

Table 2. Distribution of Women in the Two Groups (ERAS and Conventional Recovery) According to Their Demographic Characteristics, Diagnosis and Surgery

Data	Groups				P value
	Conventional		ERAS		
	N	%	N	%	
Age$^{\gamma}$	56.7	11.1	52.8	12.5	0.1$^{\delta}$
Body Mass Index (kg/m^2)$^{\gamma}$	26.8	4.8	26.4	5.2	0.7$^{\delta}$
Diagnosis					0.9$^{\alpha}$
Ovarian cancer	20	40	18	35.3	
Endometrial cancer	24	48	27	52.9	
Cervical cancer	6	12	6	11.8	
Surgery					0.2$^{\alpha}$
Hysterectomy	28	56	25	49	
Hysterectomy with pelvic lymph node dissection (PLND)	5	10	12	23.5	
Hysterectomy with pelvic lymph node dissection (PLND) and epiplectomy	11	22	8	15.7	
Radical hysterectomy (RH)	6	12	6	11.8	

α, test x^2; β, test x^2 for tension; γ, mean (Standard deviation); δ, t-test

Table 3. Distribution of Women in the Two Groups (ERAS and Conventional Recovery) According to Personal Medical History

Personal Medical History	Group				P value
	Conventional		ERAS		
	N	%	N	%	
Smoking					0.4α
No	28	56	33	64.7	
Yes	22	44	18	35.3	
Alcohol consumption					0.4α
No	41	82	45	88.2	
Yes	9	18	6	11.8	
Endocrine organs siseases					0.8α
No	29	58	31	60.8	
Yes	21	42	20	39.2	
Urinary tract diseases					0.2β
No	48	96	51	100	
Yes	2	4	0	0	
Kidney or Liver disease					0.3β
No	44	88	48	94.1	
Yes	6	12	3	5.9	
Cardiovascular system diseases					0.5α
No	35	70	39	76.5	
Yes	15	30	12	23.5	
Respiratory system diseases					0.8α
No	45	90	45	88.2	
Yes	5	10	6	11.8	
Gastrointestinal system diseases					0.7β
No	47	94	46	90.2	
Yes	3	6	5	9.8	
Skin diseases					1.0β
No	49	98	50	98	
Yes	1	2	1	2	
Nervous system disease					1.0β
No	46	92	46	90.2	
Yes	4	8	5	9.8	
Another malignancy					0.1α
No	44	88	38	74.5	
Yes	6	12	13	25.5	
Allergy					0.5α
No	41	82	39	76.5	
Yes	9	18	12	23.5	

α, test x^2; β, Fisher Exact Test

Table 4. Distribution of Women in the Two Groups (ERAS and Conventional Recovery) According to the Laboratory Tests

Laboratory tests	Group				P value
	Conventional		ERAS		
	Mean	Standard Deviation	Mean	Standard Deviation	
haemoglobin	12.6	1.5	12.7	1.1	0.7α
haematocrit	38.7	4.5	38.9	3.2	0.8α
White blood cells	7.6	2.1	6.9	2.0	0.1α
Glucose	101.0	21.2	96.7	20.9	0.3α

α, t-test

Table 5. Descriptive Results for the Days of Hospitalization in the Two Groups (ERAS and Conventional Recovery).

Length of stay (LOS)	Mean	Standard Deviation	Median	Min	Max
Conventional Group	5.9	1.6	6	3	10
ERAS	3.8	1.3	4	2	10

P value < 0.001 for two groups (Mann-Whitney U test).

while in the ERAS group it was 96%.

The rate of food intake within 6 hours in the control group reached 4.1%, while in the ERAS group it reached 88%. That is, in the ERAS group the food intake rate within 6 hours was statistically significantly greater ($p < 0.001$). The rate of early mobilisation of the digestive system in women in the ERAS group reached 92%, while in the conventional recovery group it reached 16.3%. Therefore, in the ERAS group the rate of early digestive mobilisation was statistically significantly higher ($p < 0.001$). Urine catheter removal rate in the control group was 13.6%, while in the ERAS group it was 95.6%. Therefore, in the ERAS group, the urine catheter removal rate in the first 24 hours was statistically significantly greater ($p < 0.001$). In the ERAS group, the rate of drainage removal in the first 24 hours was statistically significantly greater than in the control group ($p < 0.001$). More specifically, the drainage removal rate in the control

Table 6. Getting up in a Chair and Full Mobilization within 18 hours, food intake within 6 hours, early mobilization of the digestive system, early removal of Foley catheter and drainage in the first 24 hours, early discontinuation of IV administration and blood transfusion compared in the two groups (ERAS and Conventional Recovery).

Results	Group				P value
	Conventional		ERAS		
	N	%	N	%	
Getting up in chair within 18 hours					<0.001
No	44	89.8	3	6.1	
Yes	5	10.2	46	93.9	
N	49	100	49	100	
Full mobilization within 18 hours					<0.001
No	40	81.6	2	4	
Yes	9	18.4	48	96	
N	49	100	50	100	
Food intake within 6 hours					<0.001
No	47	95.9	6	12	
Yes	2	4.1	44	88	
N	49	100	50	100	
Early mobilization of the digestive system					<0.001
No	41	83.7	4	8	
Yes	8	16.3	46	92	
N	49	100	50	100	
Foley catheter removal					<0.001
No	38	86.4	2	4.4	
Yes	6	13.6	43	95.6	
N	44	100	45	100	
Drainage removal in the first 24 hours					<0.001
No	33	67.3	2	4	
Yes	16	32.7	48	96	
N	49	100	50	100	
Early discontinuation of IV administration					<0.001
No	47	95.9	9	18	
Yes	2	4.1	41	82	
N	49	100	50	100	
Blood transfusion					
No	41	82	51	100	
Yes	9	18	0	0	
N	50	100	51	100	

Table 7. Complications after Surgery in the Two Groups (ERAS and Conventional Recovery).

Complications	Group				P value
	Conventional		ERAS		
	N	%	N	%	
Bleeding					0.1[β]
No	44	89.8	49	98	
Yes	5	10.2	1	2	
Urinary Tract Infection (UTI)					0.1[β]
No	45	91.8	50	100	
Yes	4	8.2	0	0	
Fever					0.002[α]
No	38	77.6	49	98	
Yes	11	22.4	1	2	
Re-operation					0.6[β]
No	47	95.9	49	98	
Yes	2	4.1	1	2	

α, test x^2; β, Fisher Exact Test

group was 32.7%, while in the ERAS group it was 96%. The rate of premature discontinuation of IV administration in the control group reached 4.1%, while in the ERAS group it reached 82%. That is, in the ERAS group the rate of timely discontinuation of IV administration was statistically significantly greater ($p < 0.001$). The blood transfusion rate in women in the control group reached 18%, while in the ERAS group it was 0%, so the blood transfusion rate was statistically significantly lower in the ERAS group ($p = 0.001$). Table 6 summarises all the above data.

Regarding complications after surgery in the two groups (ERAS and Conventional Recovery), it was found that women in the ERAS group had a statistically significant lower incidence of fever. More specifically, the incidence rate of fever in women in the conventional recovery group reached 22.4%, while in the ERAS group 2% ($p = 0.002$). The rate of postoperative urinary tract infection (UTI) in women in the ERAS group was 0% while in the control group it was 8.2%. Moreover, perioperative bleeding occurred in 2% of women in the ERAS group compared to 10.2% of the control group. Finally, 2% of women in the ERAS group had to undergo reoperation to repair postoperative complications such as bleeding or ileus, compared to 4.1% of the control group Table 7 summarises the above data.

Discussion

ERAS protocols combine current evidence-based care practices aimed at reducing perioperative stress and its harmful effects on the body, enhancing postoperative recovery and ultimately reducing postoperative LOS.

In the field of gynaecological oncology, ERAS protocols have been shown to be effective in decreasing complications, shortening the LOS and lowering healthcare costs, as demonstrated by numerous studies [4, 6, 20]. Compared to conventional perioperative care, the implementation of ERAS protocols significantly improves patient outcomes [21]. This underscores the critical need for their implementation in today's healthcare systems.

The success of the ERAS protocol was based on the compliance of both healthcare professionals and patients to the prescribed care procedures. This crucial aspect has been emphasised by Bogani et al. and Gustafsson et al. [22, 23].

The mean age of women in the study was 54.7 years and their mean BMI was 26.6. The age aligns with findings reported by Wijk et al. and Ellis et al. [24, 20]. BMI was similar across all studies in participants in the two groups, respectively, which reinforces the association between obesity and gynaecologic cancer as documented in Momenimovahed et al. [25].

In this study, women from both groups exhibited similar rates of coexisting conditions based on their personal histories ($p = 0.1$ to $p = 0.8$). Additionally, no statistically significant differences were observed in preoperative laboratory testing between the two groups. This similarity enhances the comparability of the populations and strengthens the reliability of the research findings.

The women in the study underwent four main operations: "Total Hysterectomy with BSO", "Total Hysterectomy with bilateral salpingo-oophorectomy (BSO) and lymph node dissection", "Total Hysterectomy with BSO, lymph node dissection and omentectomy" and "radical total hysterectomy", with almost equal distribution in both groups (ERAS and Conventional Recovery), therefore the results of the population can be considered comparable, reliable and generalised.

An analysis of comorbidities in both patient groups revealed that the majority of women were smokers, had at least one endocrine-related condition, such as diabetes mellitus (DM) and/or thyroid disease, had hypertension and were classified as overweight. While, a smaller percentage had a history of another malignancy within the preceding decade. As shown by the research results, in women in the ERAS group the LOS was statistically

significantly lower than in the women in the control group ($p < 0.001$). Specifically, the mean LOS for the ERAS group was 3.8, compared to 5.9 days in the control group, reflecting a reduction of 2 days with the implementation of the ERAS protocol. Notably, women who underwent Total Hysterectomy under the ERAS protocol achieved the One Day Clinic (ODC) goal, improving hospital discharge. This outcome was highlighted in the preliminary results of this study published in 2019 and aligns with findings from other researchers [26].

As the day of discharge marks the endpoint of surgical treatment, LOS can be objectively compared with international studies. Importantly, the reduction in LOS did not lead to increased complication or readmission rates, confirming not only the efficacy but also the safety of the ERAS protocol in perioperative care [1, 20, 22, 27, 28]. An evaluation of postoperative standing and walking revealed that women in the ERAS group transitioned from bed to chair and achieved full mobilisation significantly faster within the first 18 postoperative hours compared to the control group ($p < 0.001$). This notable difference highlights the effectiveness of the ERAS protocol in promoting early recovery. These findings align closely with those of other researchers, further confirming and reinforcing the superiority of ERAS protocols in facilitating early mobilisation and recovery during the immediate postoperative period [21, 29, 30].

Early feeding within 4–6 hours post-operation was achieved in 88% of women in the ERAS group, compared to only 4.1% in the control group. This represents a statistically significant difference in early feeding rates ($p < 0.001$), highlighting a remarkable disparity. ERAS protocols consistently emphasise the benefits of early enteral nutrition in meeting patients' nutritional needs and reducing the risk of postoperative ileus (POI). They also underscore the positive role of postoperative fluid intake management in promoting early recovery of GOI function, facilitating early mobilisation, and ultimately reducing LOS [1, 2, 31, 32].

In women in the ERAS group, the rate of early mobilisation of the digestive system was statistically significantly higher than in the control group ($p < 0.001$). Specifically, bowel mobilisation in the ERAS group was 92% from POD-1, while in the control group it was 16.3%. These data are similar to the results of other studies [5, 6, 29, 33, 34]. This study showed that 2% of patients in the ERAS group needed to undergo surgery for POI repair, compared to 4.1% in the control group, which is double the rate. This aligns with the results from a retrospective study by Li et al., which included over 1,000 patients [35].

In the ERAS group, the rate of urine catheter removal in the first 24 hours was statistically significantly higher compared to the control group ($p < 0.001$). The study demonstrated that early removal of the urinary bladder catheter after MGOS was not associated with an increased risk of re-catheterisation. On the contrary, early catheter removal was linked to a reduced risk of UTI, as prolonged catheter use is known to be associated with higher rates of infection [36].

In the ERAS group, the rate of wound drainage removal on POD-1 was statistically significantly greater than in the control group ($p < 0.001$). Drainage can be avoided altogether or used for a short period of time in order to favour rapid mobilisation of patients. In cases where drainage was applied, it was removed within the first 24 hours in 96% of the population in the ERAS group and 32.7% in the control group. These findings are similar to the results in Chung et al. and Renaud et al. [37, 38].

In the ERAS group, the rate of early discontinuation of IV fluids and drug administration was statistically significantly greater than in the control group ($p < 0.001$). Specifically, 82% of patients in the ERAS group were able to transition from IV administration fluids to PO, compared to just 4.1% in the control group. These results align closely with those of other researchers, particularly Navarro et al. [39] and Malbrain et al. [32] and support findings by Feldheiser et al. [40] and Boitano et al. [41], who emphasized that postoperative enteral nutrition is safe, even for patients who have undergone colorectal anastomosis [33, 39-41]. Moreover, the early transition to PO intake offered the added benefit of facilitating early mobilisation, as patients were not confined to bed to receive IV fluids.

In the ERAS group, the blood transfusion rate was significantly lower compared to the control group ($p = 0.001$), despite similar preoperative haemoglobin (Hb) levels and optimization of Hb and related comorbidities in both groups prior to surgery. Notably, no patients in the ERAS group required postoperative transfusion, whereas 18% of patients in the control group did. This finding is consistent with the result of a retrospective cohort study by Joshi et al. which included 724 patients and reported a reduced need for blood transfusions in the ERAS group, and several other studies that have demonstrated lower rates of blood loss and transfusion in the ERAS groups [1, 4, 28, 34, 42–44].

In the ERAS group, the incidence of postoperative complications such as fever ($p = 0.002$) and leukocytosis ($p = 0.009$) was significantly lower than in the control group. This finding is consistent with the study by Peng et al. [45] which reported significantly lower postoperative leukocyte and neutrophil counts in ERAS patients compared to those managed with conventional care. Furthermore, these results align with evidence showing a significant reduction in the risk of surgical wound infections in patients undergoing major abdominal surgery as part of an ERAS protocol compared to standard recovery practices [46–49].

This study found no readmissions within 30 days in either group. This finding is consistent with the findings reported by Bisch et al [34]. Finally, this study demonstrated that the ERAS protocol reduces the length of stay (LOS) by 2 days, thereby lowering postoperative recovery costs and resulting in significant savings per patient. These savings benefit both individuals and the healthcare system overall, as also noted by Bisch & Nelson and Bogani et al. [6, 22]. However, to draw definitive conclusions about the economic benefit of implementing ERAS protocols in our country, specially designed fiscal studies are required.

In conclusion, the implementation of the ERAS protocol in gynaecological oncology achieves the

reduction of patients' LOS by 2 days, without increasing the rate of postoperative complications or readmission within 30 days after surgery. In particular, women of the ERAS group who underwent Total Hysterectomy with BSO successfully achieved the one-day clinic goal. The successful implementation of the ERAS protocol relies on the compliance of healthcare professionals and patient education about the specific requirements of the protocol.

The ERAS protocol in MGOS offers numerous benefits, including early enteral nutrition and discontinuation of IV fluids, early mobilisation of the digestive system, lower rates of PONV and POI, faster removal of wound drainage and urinary bladder catheter, and ultimately faster patient standing and mobilisation. The protocol is also associated with fewer blood transfusions, less drowsiness and sedation, reduced leukocytosis, and fewer episodes of postoperative fever.

Furthermore, the ERAS protocol significantly reduces the cost of postoperative care and enhances hospital workflow, yielding substantial resource savings and contributing positively to the National Healthcare System overall.

Author Contribution Statement

Dr. Maria Bourazani was the Principal Investigator of the study, owns the PhD thesis and the copyright of the study. Dr. Dimitrios Papatheodorou was the Clinical Director of the study. Dr. Petros Galanis undertook and implemented the statistical analysis of the study. Ms. Sofia Poulopoulou designed the standardized anesthesia protocol for the study. Mr. Antonis Anagnostopoulos contributed to the implementation of the protocol. Members of the three-member committee of the doctoral study were Professors Dr. Georgios Vassilopoulos and Dr. Georgia Fasoi, whereas Dr. Martha Kelesi was the Supervising Professor of the study.

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Study Registration

The study has been registered on the World Wide Web of Clinical Trials Clinicaltrials.gov (ClinicalTrials.gov, Identifier: NCT04696276).

Ethical Declaration

The study received additional approval by the Scientific Board of the Hospital where the research was conducted, with meeting number 569/19-11-2019.

Approval

The study was a part of a doctoral thesis of the Nursing Department of the University of Western Attica with approval number 8/11-09-2019 and was conducted in accordance with the Declaration of Helsinki.

Conflict of Interest

None.

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