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Evaluation of Outcomes of Minimally Invasive Surgery for Gynecologic Malignancies and Diagnosis of Patients According to CT scan and Ultrasound Techniques

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Abstract: Background: Minimally invasive surgery in oncological gynecology has shown outstanding advances in technology, better postoperative morbidity rates, and subsequent quality of life. **Objective:** This paper was designed as a cross-sectional study that contributed to assessing and analyzing the clinical outcomes of minimally invasive surgery conducted on women with gynecologic malignancies. **Patients and methods:** We recruited 60 women, aged between 30 and 60 years, with malignant tumors. All demographic and clinical data and results of patients were collected from different hospitals in Iraq during the study period, which lasted from February 6, 2022, to September 17, 2023. The data included both surgical techniques and diagnostic techniques (CT and ultrasound), surgery time, blood flow rate, hospital stay, pain, complication rate, and quality of life. **Results:** Women were conducted with a with a surgical approach that consists of laparotomy surgery, which has 30 cases, and laparoscopy surgery, which has 30 cases. Diagnostic techniques used included CT scans of 39 women and ultrasounds of 21 women. The tumor size at patients who underwent laparotomy surgery was 5.4 ± 3.1 cm, and the and tumor size at patients who underwent laparotomy surgery was 15.1 ± 6.9 cm. The operative time was 223.80 ± 90.12 minutes for patients with laparotomy surgery and 215.23 ± 74.57 for patients with laparotomy surgery. Blood loss was 181.51 ± 119.84 mL for the laparoscopy surgery and 474.29 ± 390.56 in the laparotomy surgery, hospital stays were 4.7 ± 3.1 laparoscopy surgery and 8.9 ± 3.1 in the laparotomy surgery, intensive care unit admission was two women and mortality rate was 0% in the laparoscopy surgery while intensive care unit admission was four women and mortality rate was 16.67% in the laparotomy surgery, complications rate of laparoscopy surgery was five women while complications rate of laparoscopy surgery was 15 women, the most factors were infection, bleeding, and pain. **Conclusion:** Our current study demonstrated that minimally invasive surgery is the best and most effective treatment for gynecological malignancies, leading to improvements in women's function and quality of life after surgery.

Keywords: Minimally Invasive Surgery; Gynecologic Malignancies; CT; Ultrasound; Post – complications; Quality of life; and Blood flow rate.

INTRODUCTION

The surgical treatment of gynecological cancer has benefited from significant changes in recent decades. The first publications of a minimally invasive treatment for gynecological cancer were in 1992. [Kaur, M. *et al*., 2014]

Thus, in the late 1990s and early 2000s, most of the publications reporting on the use of laparoscopy for the surgical treatment of gynecological cancer were limited to a case series. [Cibula, D, 2019]

Laparoscopy was first used by gynecologists, but general surgeons were the first to demonstrate that laparoscopy could be used for the treatment of cancer, especially colon cancer, without compromising the survival of patients where these techniques were used. [Khoury-Collado, F. *et al*., 2012]

Minimally invasive surgery has been widely accepted by both professionals and patients in benign pathology and is of medium complexity in adnexal or uterine pathology [Chiantera, V. *et al*., 2014]. This has encouraged the development of laparoscopic techniques for the exploration, staging, and resection of gynecological cancer. However, its implementation to treat gynecological cancer is slower [Schmidt, A-M. *et al*., 2012]. The main reasons for the slow implementation are due to the technical complexity of the surgeries, which require a long

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learning curve and are often relegated to third-level centers. [Chiantera, V. *et al*., 2014]

Currently, numerous randomized prospective studies have demonstrated safety in terms of quality of life and survival and benefits in terms of blood loss, postoperative pain, perioperative complications, shorter hospitalization time, and faster recovery from laparoscopy versus laparotomy in malignant pathology [Brunschwig, A. *et al*., 1948]. These results indicate the potential use of laparoscopy in certain gynecological cancer patients [Magrina, J. F. *et al*., 1997]. What the current scientific evidence does highlight is that cancer outcomes for patients undergoing minimally invasive staging procedures appear to be comparable to open staging procedures in women with early-stage disease. [Puntambekar, S. *et al*., 2016; Bizzarri, N. *et al*., 2019]

Laparoscopic surgery (LS) is a minimally invasive technique that describes the use of a single incision to perform the surgical procedure [Matsuo, K]. This technique, which results in a better aesthetic result for patients, has also been shown to generate a shorter period of disability, rapid recovery, and reduced postoperative analgesia requirements compared to patients treated with conventional laparoscopic approaches [Martínez, A. *et al*., 2011; Kanao, H. *et al*., 2021]. Also, by having a more extensive incision, it is easier to remove larger surgical pieces without enlarging them, which allows C02 insufflation to be performed again if required [Kanao, H. *et al*., 2021]. The data published in the current literature, in the areas of gynecology and gynecologic oncology, have demonstrated the technical feasibility and reproducibility of this surgery when used for a variety of procedures, including total hysterectomy, risk-reducing salpingo-oophorectomy, ovarian and pelvic tumor resection, and more complex procedures such as radical hysterectomy and pelvic lymphadenectomy. [Jain, V. *et al*., 2021; Karkia, R. *et al*., 2022]

Both CT scans and ultrasounds are crucial in the detection and identification of malignant gynecological tumors; where CT scans employ multiple X-ray images to generate comprehensive cross-sectional images in the body, facilitating the determination of the size, setting, and extent of gynecological tumors, as well as CT scans are particularly valuable for identifying tumors at the pelvis and abdomen, as well as assessing the potential spread of cancer to adjacent lymph nodes or other organs. [Vizzielli, G. *et al*., 2018; Rosenthal, R. *et al*., 2015]

Ultrasound is a non-invasive imaging technique that utilizes sound waves to generate images for the pelvic organs, including the uterus, ovaries, as well as fallopian tubes, which it is commonly employed as an initial diagnostic test for gynecological conditions due to its non-invasive nature and absence of radiation, where ultrasounds aid in the detection of tumors, evaluation of their dimensions and morphology, and determination of whether the tumors are solid or fluid filled. [Kanao, H. *et al*., 2021; Jain, V. *et al*., 2021; Rosenthal, R. *et al*., 2015]

New innovations constantly emerge to perform the most complex procedures in a less invasive manner. However, with the spread of new technologies, we must critically evaluate these techniques to ensure that perioperative morbidity and oncological outcomes are at least equivalent or superior to traditional surgical approaches. [US Department of Health and Human Services, 2017]

PATIENTS AND METHODS

We conducted a cross-sectional study on 60 women with malignant tumors, ranging in age from 30 to 60 years. Clinical and surgical data were collected for patients from different hospitals in Iraq for the period of the study, which ranged from February 6, 2022, to September 17, 2023. The demographic and clinical data before surgery included age, body mass index, worst classification, symptoms, comorbidities, surgical procedure (laparotomy and laparoscopy), and diagnostic techniques (CT scan and ultrasound).

We distributed diagnostic techniques to all patients, which allowed us to identify the tumor locations and histology. Also, our study determined the pathological outcomes of women with gynecological malignancies for both abdominal surgery and laparoscopy, which consisted of time from diagnosis to pelvic emission, months, tumor size, and FIGO stages, which included IA, IB, IC, IIA, and IIB.

Regarding intraoperative and postoperative outcomes, this study compared both surgeries, which consisted of laparoscopic surgery, which included 30 women, and laparoscopic surgery, which included 30 women. Surgical and clinical data included operating time, blood loss (ml), blood transfusion, tumor rupture, and stay. In the hospital, time to tolerate oral diet, time to mobilization and ICU admission, mortality rate,

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and complication rate. Regarding the results, rates of pain, and quality of life, this study evaluated the rate of pain for both patients who underwent laparotomy and laparoscopy in the first five days after surgery using the Fas scale, where 0 represents recovery from pain for patients, and 10 represents severe pain for patients.

Also, this study evaluated the quality of life of patients through a questionnaire that most women underwent and by determining the standard for the quality of life of patients, which ranges between 0 and 100, where 0 is the worst degree for the quality of life of patients, and 100 is the optimal degree for the quality of life of patients, as the criteria included physical function, psychological function, social and emotional function, and daily activity. Furthermore, we performed a Kaplan-Meier analysis of the survival rate of patients with gynecological malignancies who underwent abdominal surgery and laparoscopy during the 3-month follow-up period.

RESULTS

Our findings were enrolled in demographic and preoperative data where women aged (51 – 60) years was 50%, followed by women with ages (41 – 50) years were 35%, and most of women with BMI have obesity where have BMI (30 – 34.9) kg/m^2 had 21 cases, BMI (≥ 35) kg/m^2 had 15 women, most common symptoms were pelvic pain with 40%, abnormal vaginal bleeding with 25%, and changes in bowel with 15%, most comorbidities spread in the women were hypertension had 90% of women, diabetes included 60% of women, and obesity had 70% 0f women, women were conducted surgical approach which consists of laparotomy surgery who have 30 cases and laparoscopy surgery have 30 cases, diagnoses techniques used CT scan included 39 women and ultrasounds included 21 women.

Table 1: Demographic and preoperative data of women with gynecologic malignancies

Characteristics	Number of patients [60]	Percentage [%]
Age		
30 – 40	9	15%
41 – 50	21	35%
51 – 60	30	50%
BMI, [kg/m^2]		
18.5 – 24.9	12	20%
25 – 29.9	12	20%
30 – 34.9	21	35%
≥ 35	15	25%
ASA score		
I	3	5%
II	54	90%
III	3	5%
Symptoms		
Abnormal vaginal bleeding	15	25%
Pelvic pain	24	40%
Changes in bowel	9	15%
Bloating	3	5%
Feeling full quickly when eating	6	10%
Unexplained weight loss	3	5%
Comorbidities		
Hypertension	54	90%
Diabetes	36	60%
Obesity	42	70%
Cardiovascular disease	18	30%
Kidney diseases	12	20%
Surgical approach		
Laparotomy	30	50%
Laparoscopy	30	50%
Diagnoses techniques		
CT scan	39	65.0%
Ultrasound	21	35.0%

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In Figure 1, our study has shown the site of tumors spread into women where most sites were cervix have 33 women, and uterine corpus have 12 women. Also, we distributed histology to women patients with gynecologic malignancies, which include serous with 33 women, clear cell with 12 women, and endometrioid with nine women.

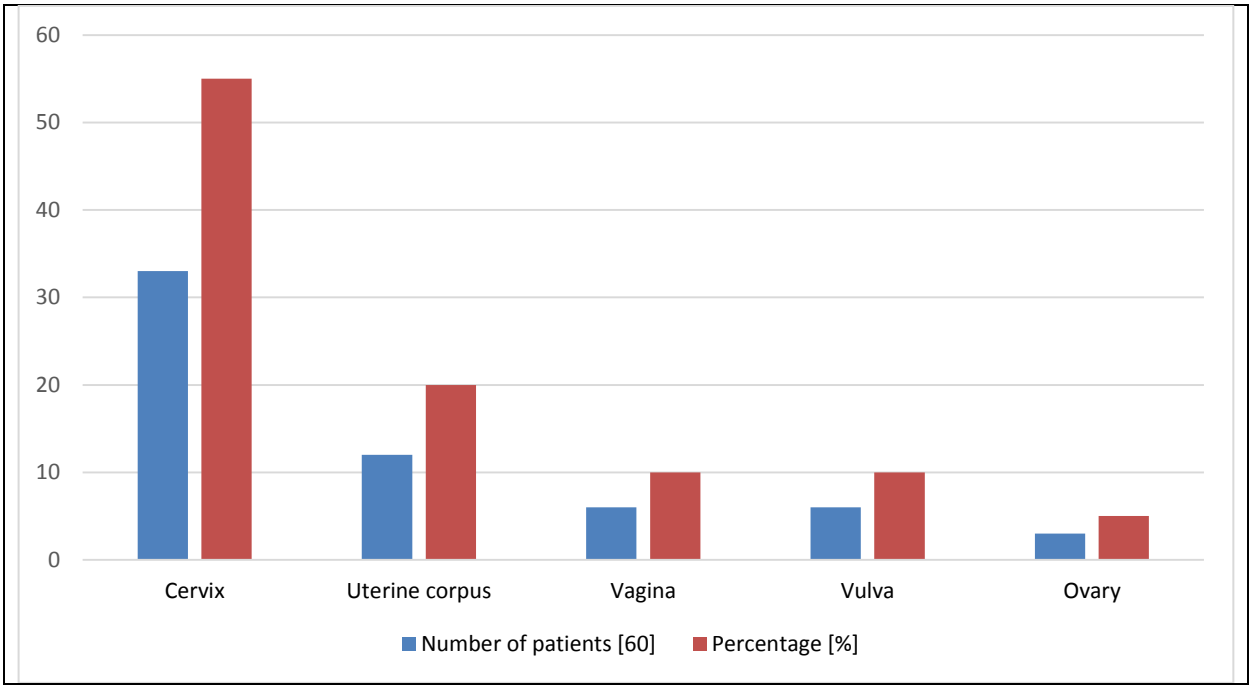

Figure 1: Distribution of patients with gynecologic malignancies according to site of primary disease

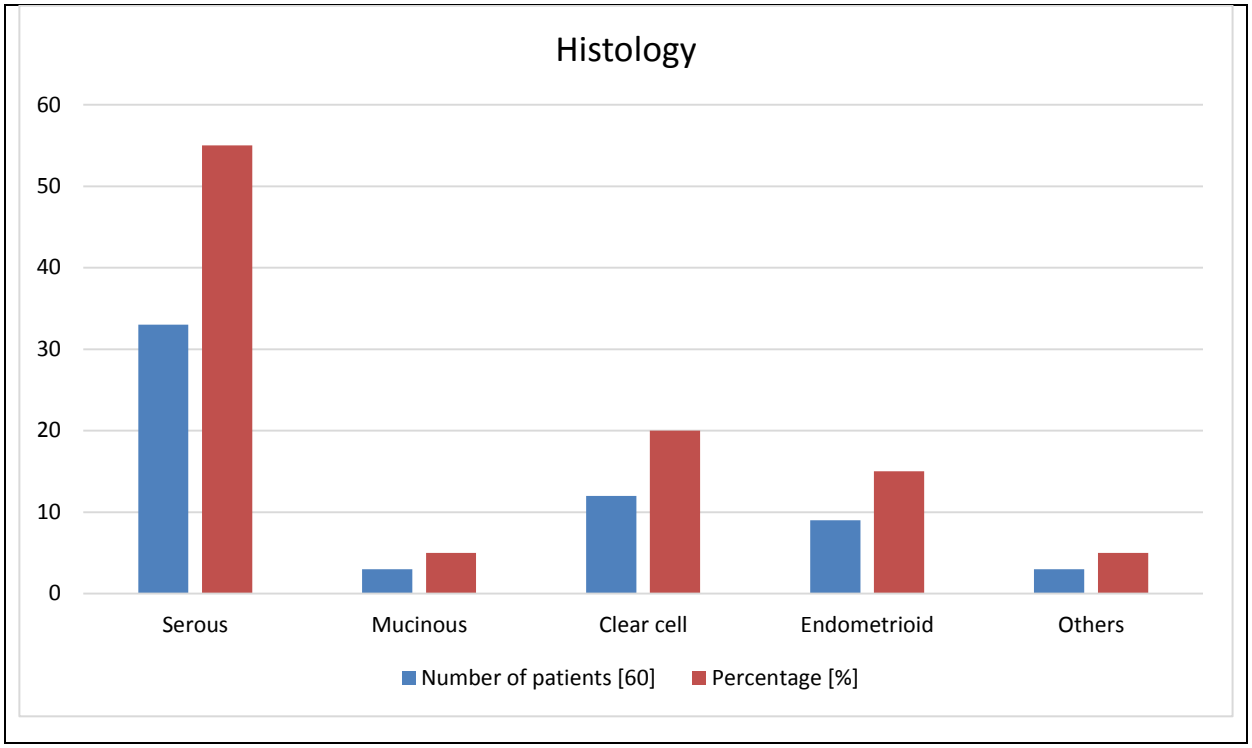

Figure 2: Distribution of patients with gynecologic malignancies according to histology

According to Table 2, our study enrolled pathological findings, where found time from diagnosis to pelvic exenteration was 19.0 ± 2.0 in the laparoscopy surgery group and 15.0 ± 1.0 in the laparotomy surgery group, tumor size at patients who underwent to laparoscopy surgery was 5.4 ± 3.1 cm, tumor size at patients who underwent to laparotomy surgery was 15.1 ± 6.9 cm, grade III was highest which include 48 patients who underwent to laparoscopy surgery

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and 45 patients who underwent to laparotomy surgery, FIGO stages were IC as highest stage of tumor which include 24 cases as same as IA was 24 within patients who underwent to laparoscopy surgery and IA include 27 patients and 24 patients in the laparotomy surgery group.

Table 2: Determining pathological findings of women with gynecologic malignancies for both of laparotomy and laparoscopy surgeries

Variables	Laparoscopy surgery [30]	Laparotomy surgery [30]	P – value
Time from diagnosis to pelvic exenteration, months	19.0 ± 2.0	15.0 ± 1.0	0.25
Type of exenteration			0.20
Supralevator	15 (25%)	12 (20%)	
Infralevator	42 (70%)	45 (75%)	
Infralevator with vulvectomy	3 (5%)	3 (5%)	
Tumor size (cm)	5.4 ± 3.1	15.1 ± 6.9	0.025
Grade			0.61
I	3 (5%)	12 (20%)	
II	9 (15%)	3 (5%)	
III	48 (80%)	45 (75%)	
FIGO stage			0.51
IA	24 (40%)	27 (45%)	
IB	2 (3.33%)	3 (5%)	
IC	24 (40%)	24 (40%)	
IIA	6 (10%)	1 (1.67%)	
IIB	4 (6.67%)	5 (8.33%)	

Our study was enrolled intraoperative surgical outcomes, which consists of an operative time was 223.80 ± 90.12 minutes for patients with laparoscopy surgery and 215.23 ± 74.57 for patients with laparotomy surgery, Blood loss was 181.51 ± 119.84 mL with only one case in the laparoscopy surgery and 474.29 ± 390.56 with 7 cases in the laparotomy surgery, time to abdominal drain removal was 3.3 ± 1.5 days in the laparoscopy surgery and 6.0 ± 3.8 days in the laparotomy surgery, hospital stays was 4.7 ± 3.1 laparoscopy surgery and 8.9 ± 3.1 in the laparotomy surgery, intensive care unit admission was two women and mortality rate was 0 % in the laparoscopy surgery while intensive care unit admission was four women and mortality rate was 16.67% in the laparotomy surgery, complications rate of laparoscopy surgery was five women while complications rate of laparoscopy surgery was 15 women, the most factors were infection, bleeding, and pain where all these results were found in the Table 3 and Table 4.

Table 3: Identify intraoperative surgical outcomes

Variables	Laparoscopy surgery	Laparotomy surgery	P – value
Operative time (min), mean±SD	223.80 ± 90.12	215.23 ± 74.57	0.71
Blood loss (mL), mean±SD	181.51 ± 119.84	474.29 ± 390.56	0.025
Blood transfusion, n (%)	1 (3.33%)	7 (23.33%)	0.032
Tumor rupture, n (%)	5 (16.67%)	9 (30%)	0.782
Time to abdominal drain removal (days)	3.3 ± 1.5	6.0 ± 3.8	0.018
Hospital stays (days)	4.7 ± 3.1	8.9 ± 3.1	0.0142
Time to oral diet tolerance (h)			0.12
< 24	24 (80%)	21 (70%)	
≥ 24	6 (20%)	9 (30%)	
Time to mobilization (h)			0.15
< 24	23 (76.67%)	18 (60%)	
≥ 24	7 (23.33%)	12 (40%)	
Time to urinary catheter removal (h)			0.046
< 24	20 (66.67%)	12 (40%)	
≥ 24	10 (33.33%)	18 (60%)	

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Intensive care unit admission			< 0.01
Yes	2 (6.67%)	4 (13.33%)	
No	28 (93.33%)	26 (86.67%)	
Mortality rate			< 0.001
Death	0 (0%)	5 (16.67%)	
Alive	30 (100%)	25 (83.33%)	

Table 4: Postoperative complications

Complications	Laparoscopy surgeries	Laparotomy surgery	P – value
Infection	3 (10%)	4 (13.33%)	0.0362
Bleeding	0 (0%)	3 (10%)	0.025
Pain	1 (1.67%)	3 (5%)	0.048
Lymphedema	1 (1.67%)	2 (3.33%)	0.0492
Blood clots	0 (0%)	2 (3.33%)	0.044
Damage to surrounding organs	0 (0%)	1 (1.67%)	0.047
Total	5 (13.33%)	15 (36.76%)	0.022

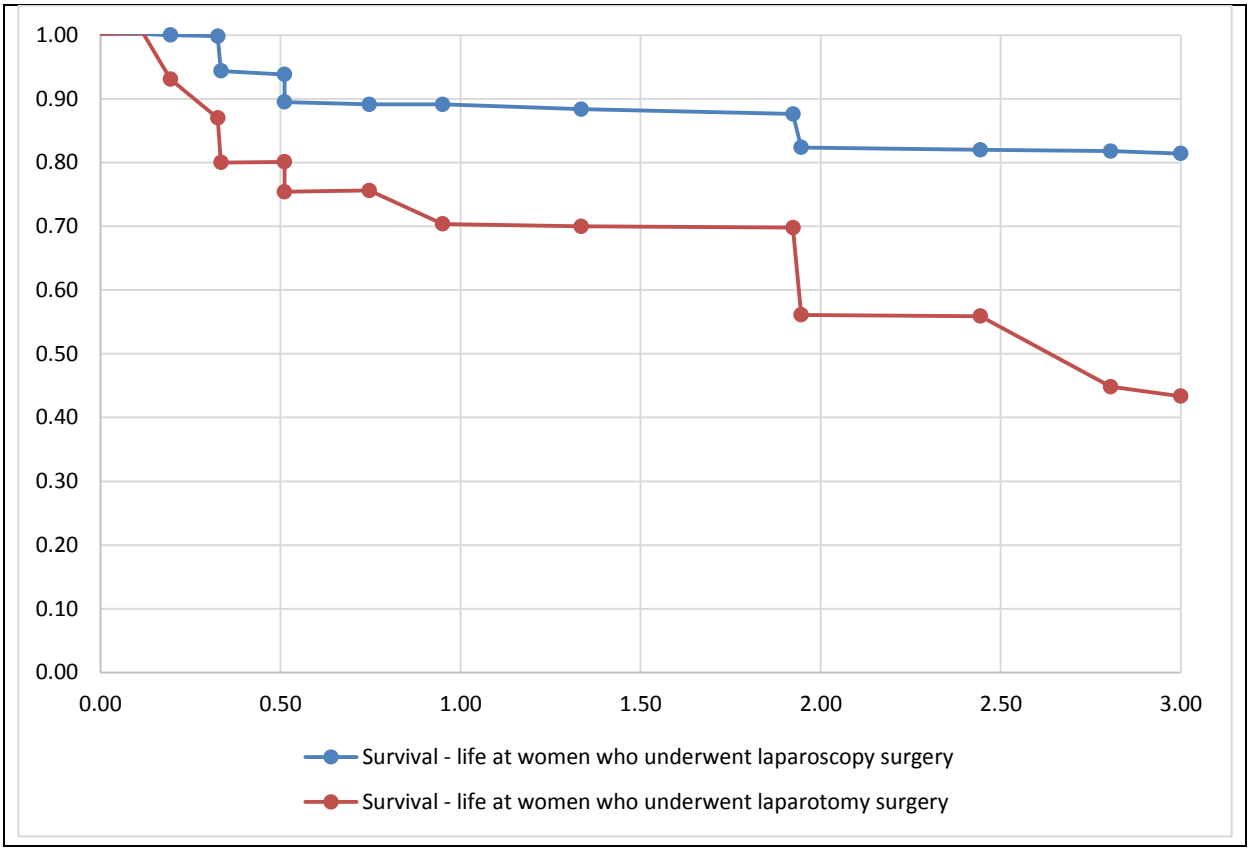

Figure 3: Kaplan–Meier analysis of survival life rate for patients with gynecologic malignancies who underwent laparotomy and laparoscopy surgeries

The maximum scores of the pain scale were 5.2 ± 0.4 in 1st day, and a minimum score of pain was 0 on the 5th day for patients who underwent laparoscopy surgery, while the maximum scores of the pain scale were 7.0 ± 1.0 in 1st day, and a minimum score of pain was 1.03 ± 0.002 5th day for patients who underwent laparotomy surgery. In addition, quality of life scores found physical function was 82.35 ± 8.64, and daily activity was 86.65 ± 8.22 for patients who underwent laparoscopy surgery, and physical function was 62.13 ± 6.95, and social and emotional functions were 71.24 ± 6.92 for patients who underwent laparotomy surgery.

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Table 5: Assessment of pain scores of women with gynecologic malignancies who underwent laparotomy and laparoscopy surgeries

Postoperative time (days)	Laparoscopy surgery	Laparotomy surgery	P – value
1st day	5.2 ± 0.4	7.0 ± 1.0	0.045
2nd day	3.3 ± 0.22	5.7 ± 0.11	0.034
3rd day	2.20 ± 1.16	4.84 ± 0.65	< 0.001
4th day	1.01 ± 0.26	3.56 ± 1.04	< 0.001
5th day	0	1.03 ± 0.002	0.011

Table 6: Assessment of quality of life of patients with gynecologic malignancies who underwent laparotomy and laparoscopy surgeries

Items	Laparoscopy surgeries	Laparotomy surgery	P – value
Physical function	82.35 ± 8.64	62.13 ± 6.95	< 0.001
Psychological function	84.27 ± 7.89	70.53 ± 4.36	< 0.01
Social and emotional functions	89.85 ± 4.32	71.24 ± 6.92	< 0.01
Daily activity	86.65 ± 8.22	60.57 ± 5.51	< 0.001

DISCUSSION

Last studies found that minimally invasive operations often result in expedited recovery periods and less tissue damage in compared to conventional open surgical procedures, where the phenomenon could contribute to enhanced post-operative functioning as well as a more expedited resumption in regular activities. [Dindo, D. *et al*., 2004]

Minimally invasive surgical procedures have been shown to exhibit reduced rates of blood loss in comparison with traditional surgical procedures, which this phenomenon has the potential to decrease the likelihood of problems associated with blood loss as well as expedite the process of recovery. [US Department of Health and Human Services, 2022]

Studies have shown that minimally invasive surgery is correlated with reduced incidences of complications, including infections, wound healing problems, and other post-operative consequences, in comparison to conventional open operations. [PelvEx Collaborative, 2019]

Amercian study has shown that there is a common correlation among minimally invasive operations and reduced post-operative discomfort in comparison to conventional open surgeries, which aforementioned outcome has the potential to enhance patient comfort as well as overall satisfaction throughout the surgical procedure. [Jurado, M. *et al*., 2010]

The use of minimally invasive surgery has the potential to enhance the overall well-being of patients by mitigating the physiological and psychological strain often associated with surgical procedures, where atients may potentially encounter expedited recuperation periods, decreased pain levels, and expedited resumption of routine activities, each of which might together lead to enhanced quality of life. [Dindo, D. *et al*., 2004; PelvEx Collaborative, 2019; Jurado, M. *et al*., 2018]

In comparison to conventional open procedures, minimally invasive surgeries frequently require shorter durations of hospitalization, which these outcomes may include fewer healthcare expenses, expedited reintegration into work and life at home, and a reduced likelihood of acquiring infections in the hospital. [Höckel, M, 2003 – Ramirez, P. T. *et al*., 2018]

In the realm of gynecological malignancies, most of the studies ensurd that minimally invasive surgery presents numerous benefits since compared to conventional open surgeries, where hese advantages encompass enhanced functional outcomes, diminished blood loss, decreased incidence of complications, diminished post-operative pain, better quality of life, and abbreviated hospital stays. [PelvEx Collaborative, 2018; Parekh, D. J. *et al*., 2018]

CONCLUSION:

As a result of our study, minimally invasive surgery is clearly the most effective and successful way to treat gynecological malignancies. Due to significantly lower blood flow, complications, and pain, patients stay in the hospital for shorter periods of time and recover faster, which leads to better quality of life and lower mortality rates for women who have had surgery.

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