Surgical Outcomes of Laparoscopy Versus Laparotomy for Treatment of Small Benign Ovarian Masses; Prospective Study

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Abstract:

Background: Adnexal masses are common neoplastic lesions in females. Laparoscopy is considered the gold standard for treatment of benign ovarian cysts. Compared with traditional surgery by laparotomy, operative laparoscopy is associated with a shorter hospital stay, faster recovery, decreased costs, and a lower incidence of postoperative adhesion formation. In this study we aimed for comparison between laparoscopy and conventional open exploration for benign ovarian masses.

Methods: This prospective study for females aged 18 – 67 years with ovarian mass referred to surgical oncology department in SECI, Assiut University during 2018-2019 by convenience sampling. This study includes 15 cases for laparoscopic group and 15 cases for laparotomy group. Statistical Package for the Social Sciences (SPSS 24) was used for analysis.

Results: Thirty patients presented with benign ovarian lesions (15 patients underwent laparoscopic excision and the other 15 patients underwent conventional open excision). The mean age for laparoscopic cases was about 41.93 ± 14.5 years old and about 39.80 ± 12.4 years old for open cases. The mean duration of surgery and anesthesia in laparoscopic group was significantly more than in laparotomy patients with p-value < 0.001 but the estimated blood loss (EBL) was higher for open cases (about 1.63 ± 0.1L) while for laparoscopic cases was 0.10 ± 0.01L with p-value < 0.001. There were no significant differences between the two patient groups as regards intraoperative complications with p-value = 0.524. For laparoscopic cases, extraction of the ovarian lesions either by Pfannenstiel incision in 9 cases (60%) while 3 cases (20%) from trocar sites and the other 3 cases (20%) extraction of the specimen done transvaginally. For open exploration cases, 11 cases (73.3%) explored by midline incision and 4 cases (26.7%) done through Pfannenstiel incision. post-operative bowel recovery, postoperative pain, hospital stay were significantly better for laparoscopic group with p-value < 0.001.

Conclusion: Laparoscopic management of ovarian masses is a better choice for the management of benign ovarian mass with better thorough exploration and faster bowel recovery, less blood loss, shorter time of hospitalization and less post-operative pain but longer operative time.

Keywords: Benign ovarian mass, laparoscopy, laparotomy.

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Introduction:

Adnexal masses, including any mass in the ovaries and fallopian tubes, are the most common problem affecting females of all ages[1]. These masses are among the most important neoplastic lesions seen in women and may be benign or malignant[2].

Laparoscopic surgery is one of the most widely used minimally invasive surgical techniques in gynecology. Compared to open surgery, laparoscopic surgery has many advantages, including wound complications, poor perioperative outcomes, blood transfusions, admission to the intensive care unit (ICU) and a lower rate of readmission[3, 4].

Although conventional laparoscopic surgery is less invasive than open surgery, it still leaves 3 to 4 surgical scars at the incision site. Today, patient satisfaction with the appearance of the scars is becoming increasingly important, and this is an important factor influencing the choice of surgical approach, especially for young women[5].

Improved flexible optical and endoscopic instrumentation has led to the further development of

single-port laparoscopy, which is called laparo-endoscopic single-site surgery (LESS)[6]. The laparoscopic treatment of simple cysts is not limited by their diameter. Although there were not described any significant complications even after spillage of the contents of the cyst into the abdominal cavity, laparoscopy enables decompression of the content prior to excision under direct vision by percutaneous puncture or insertion of a suction catheter into the lumen of the cyst[7, 8]. There are three options for removing an ovarian cyst laparoscopically: adnexectomy (salpingo-oopherectomy), oophorectomy, or conservative cystectomy alone[9]. In most cases, conservative cystectomy is performed, and it is the first choice when the patient is young or the cyst is not suspicious for malignancy[10].

In this study our aim is to evaluate the short term postoperative outcomes of minimally invasive laparoscopic surgery in the management of benign ovarian masses and to assesses the safety of laparoscopic approach.

Patients and Methods:

This study was performed as a prospective cohort study on women with benign ovarian masses admitted to the surgical oncology department at SECI, Assiut University in 2018-2019. Totally 30 patients were included in the study (15 cases for laparoscopic group and 15 cases for laparotomy group).

Inclusion criteria were females (18-67 years old) who candidates for laparoscopic surgery or laparotomy for ovarian masses according to preoperative assessments (such as tumor markers as CA125, LDH, AFP and the size of ovarian mass by radiology as CT or MRI). Exclusion criteria were malignant ovarian masses, peritoneal metastasis, distant metastasis as pulmonary nodules, previous multiple laparotomies or unfit patients.

Procedure:

-Preoperative assessment of all patients by demographic data [age, body mass index (BMI)], radiological evaluation [by ultrasound (transabdominal and transvaginal), CT or MRI], laterality (unilateral or bilateral), serum tumor markers as CA 125 level, AFP level, LDH level and β-HCG level.

-The surgical interventions were performed with the patient under general anesthesia with endotracheal intubation and some patients under spinal anesthesia according to a standard anesthetic regimen. The decision for the extent of surgery depended on the clinical situation. Laparotomy was performed through either a Pfannenstiel or infraumbilical midline incision with the use of a standard surgical technique [Fig.1&2].

All laparoscopic procedures were performed through three ports, a 10 mm supraumbilical port for the laparoscope and a 10 mm ports on the right and left lower abdomen [Fig.3&4&5]. Firstly, through exploration of the abdomen and evaluation of the ovarian mass. Dissection was carried out with either a curved dissector or scissors and hemostasis was achieved with bipolar coagulation. All operations were carried out with a technique simulating that was performed by laparotomy without intentionally puncturing the tumor. Specimens were removed by a bag-retrieval technique through either port or through Pfannenstiel incision. Also, evaluation of the intraoperative amount of bleeding during surgery and need for intraoperative blood transfusion, complications during surgery), operative time and conversion to conventional laparotomy.

-Postoperative evaluation of postoperative pathology, gastrointestinal (GIT) recovery and hospital stay, postoperative complications. Finally, all data collected from patients were compared between the two groups of laparoscopy and laparotomy.

Statistical Analysis:

Data were verified, coded by the researcher, and analyzed using SPSS version 24. Descriptive statistics: Means, standard deviations, median, range and percentages were calculated. Test of significances: chi-square/Fisher's Exact test was used to compare the difference in the distribution of frequencies among different groups. Independent t-test analysis was carried out to compare the means of normally distributed data. A p-value less than 0.05 was considered significant.

Ethical considerations:

Approval for this study was obtained from The Institutional review board (IRB) of South Egypt Cancer Institute-Assiut University prior to study execution. In addition, all participants received a written consent form. The informed consent was clear and indicated the purpose of the study, and their freedom to participate or withdraw at any time without any obligation. Furthermore, participants' confidentiality and anonymity were assured by assigning each participant with a code number for the purpose of analysis only. The study was not based on any incentives or rewards for the participants. The study was in line with the Declaration of Helsinki.

Results:

These benign ovarian cases were managed either laparoscopic (15 cases) and conventional open intervention (15 cases). For preoperative data for both groups (Table 1), The mean age for laparoscopic cases was about 41.93 ± 14.5years old and about 39.80 ± 12.4 years old for open cases with p-value= 0.668, The BMI for laparoscopic cases was not significant between both groups about 27.60 ± 6.3and for open cases was 28.53 ± 6.3. Unilateral ovarian mass was in 25 cases (13 cases managed laparoscopically and 12 cases managed by exploration) and these cases managed surgically by salpingoophrectomy. Bilateral ovarian masses were in 5 cases (two cases were managed laparoscopically and 3 cases were managed by exploration) and these cases managed by surgical staging. The size of the ovarian mass was significant between the two groups where open conventional intervention was for larger masses about 14.73 ± 5.95/cm while laparoscopy for smaller

lesions about 8.40 ± 1.76/ cm with p-value = 0.012. Ascites was presented in 11 cases (73.3 %) (10 cases were minimal and one case was moderate ascites). Preoperative tumor marker level was raised only in 7 cases (4 cases done laparoscopically and 3 cases done by open procedure) with no significant relation for differentiation between benign or malignant ovarian mass (p-value = 0.671).

As regard intraoperative comparison of different data (Table 2), the operative time of the laparoscopic cases (the mean time was 1.23 ± 0.1/h) was longer than open cases (the mean time was 0.07 ± 0.01/h) with significant difference between both groups with p-value < 0.001 but the blood loss was higher for open cases (about 1.63 ± 0.1L) while for laparoscopic cases was 0.10 ± 0.01L with p-value < 0.001. [Fig. 6]

Intraoperative complications (Table 2) were occurred in two cases (13.3%) of laparoscopy as intraoperative bleeding from infundibulopelvic ligament vessels and bladder injury. Also for open exploration cases, the intraoperative complications like ureteric injury &intraoperative bleeding and small intestinal injury in three cases (20%) with no significant statistical data (p-value= 0.524). For cases managed laparoscopically, 13 cases (86.7%) underwent salpingoophrectomy either unilateral or bilateral, but 8 cases (53.3%) underwent open salpingoophrectomy either unilateral or bilateral. Total abdominal hysterectomy was done in 2 cases (13.3%) of laparoscopy group while 7 cases (46.7%) managed by conventional open procedure. Total abdominal hysterectomy was done for these 9 cases depending upon preoperative radiological suspicious malignant criteria in CT or MRI as complex ovarian mass with solid and cystic components with ascites and raised tumor markers and after exploration and total abdominal hysterectomy with final postoperative pathology show benign neoplasm of these suspicious ovarian masses.

For laparoscopic cases, extraction of the ovarian lesions either by Pfannenstiel incision in 9 cases (60%) while 3 cases (20%) from trocar sites and the other 3 cases (20%) extraction of the specimen done transvaginally. For open exploration cases, 11 cases (73.3%) explored by midline incision and 4 cases (26.7%) done through Pfannenstiel incision [Fig.7].

Postoperative short term data (Table 3) shows the significance of laparoscopic intervention over the conventional open procedure as regards the GIT recovery for laparoscopic cases after 1.07 ± 0.1 days versus 2.76 ± 0.3 days for open cases with a significant p-value < 0.001 [Fig.8]. Also, the intensive care unit (ICU) stay was 0.13 ± 0.1day in two cases only of laparoscopic cases, but up to 2.40 ± 0.4 days for open cases with a significant p-value < 0.001. Hospital stay was longer for open cases (mean stay 7.60 ± 1.0 days) while for laparoscopic cases was 2.27 ± 0.4 days with significant p-value < 0.001 [Fig.9].

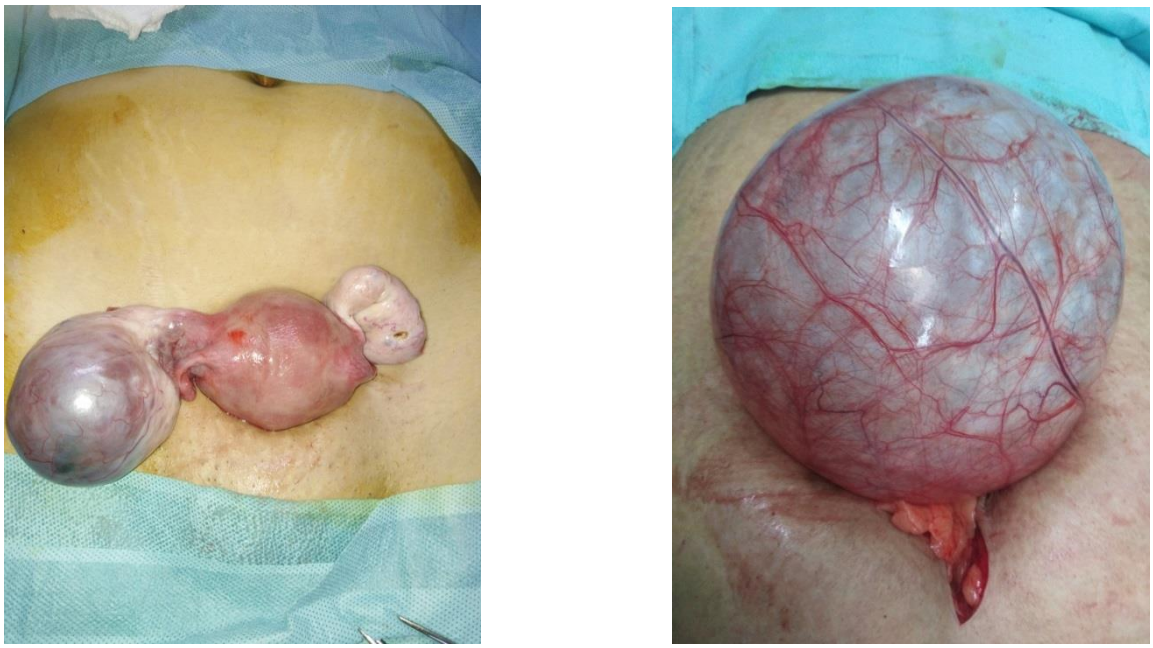

Fig. 1&2: Show laparotomy incisions either pfannenstiel or infraumbilical midline incisions


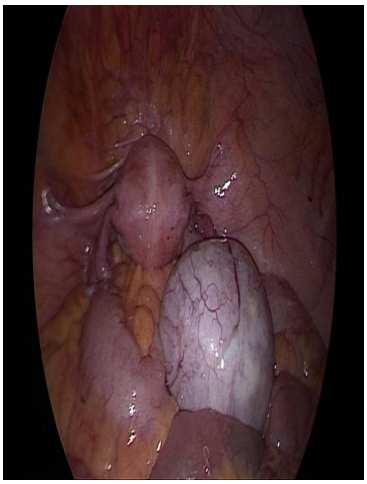
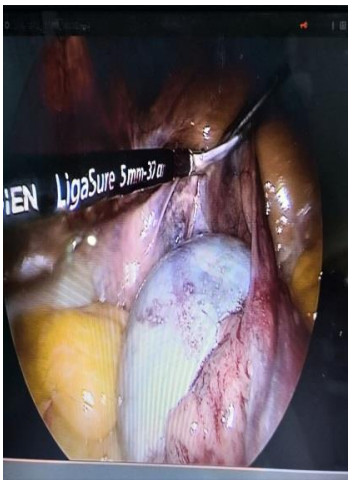

Fig. 3&4&5: Show laparoscopic port sites and right adnexal mass with right salpingoophrectomy

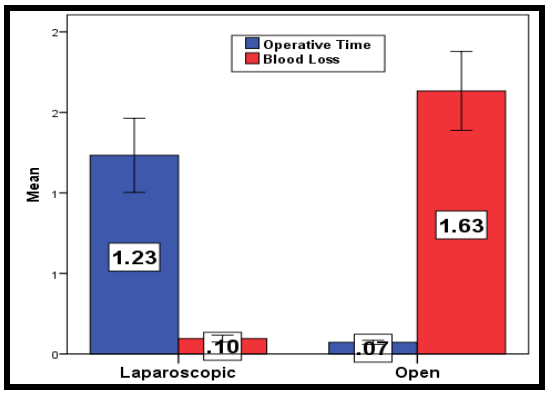

Fig.6: Mean operative time and blood loss among the studied sample

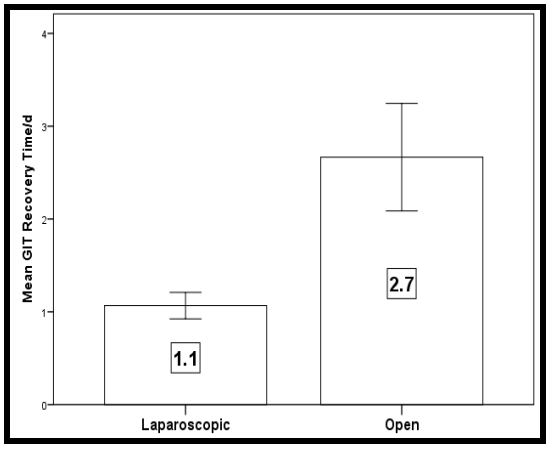

Fig. 8: Mean GIT recovery duration among the studied sample

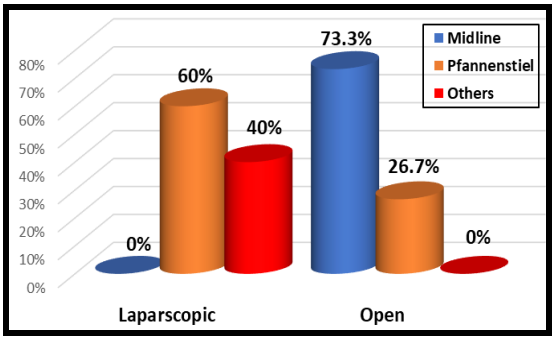

Fig.7: Distribution of the studied sample according to type of incision

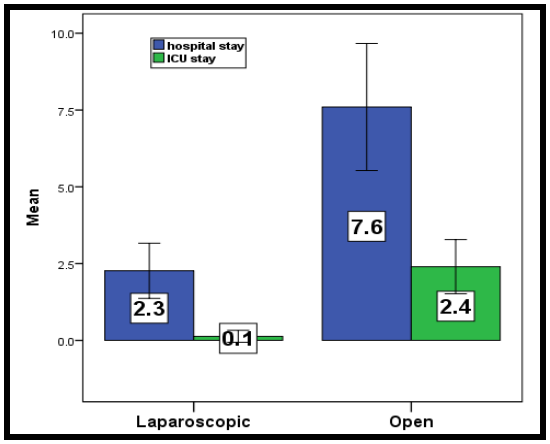

Fig. 9: Mean hospital and ICU stay among the studied sample

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Table 1: Pre-operative data of both groups

Parameter	Laparoscopic (n = 15)	Open (n = 15)	P-value
Age/years	41.93 ± 14.5	39.80 ± 12.4	0.668*
BMI	27.60 ± 6.3	28.53 ± 6.3	0.678*
Laterality			0.524**
• **Unilateral**	13 (86.7%)	12 (80%)	
• **Bilateral**	2 (13.3%)	3 (20%)	
Tumor Size/cm	8.40 ± 1.76	14.73 ± 5.95	**0.012***
Ascites			
• **No**	10 (66.7%)	9 (60%)	
• **Minimal**	5 (33.3%)	5 (33.3%)	0.517**
• **Moderate**	0 (0%)	1 (6.7%)	
Tumor Marker			
• **Normal Level**	11 (73.3%)	12 (80%)	0.671**
• **Raised Level**	4 (26.7%)	3 (20%)	

*Student t-test was used to compare the mean difference between groups
**Chi-square test was used to compare proportions between groups

Table 2: Intra-operative data of both groups

Parameter	Laparoscopic (n = 15)	Open (n = 15)	P-value
Operative Time/hour	1.23 ± 0.1	0.07 ± 0.01	< **0.001***
Blood Loss/L	0.10 ± 0.01	1.63 ± 0.1	< **0.001***
Intraoperative Complications			
• **No**	13 (86.7%)	12 (80%)	0.524**
• **Yes**	2 (13.3%)	3 (20%)	
Type of surgical intervention			**0.109****
• **Salpingoophrectomy**	13 (86.7%)	8 (53.3%)	
• **Hysterectomy**	2 (13.3%)	7 (46.7%)	
Incisions			
• **Midline**	0 (0%)	11 (73.3%)	< **0.001****
• **Pfannenstiel**	9 (60%)	4 (26.7%)	
• **Others**[$]	6 (40%)	0 (0%)	

*Student t-test was used to compare the mean difference between groups
*Chi-square test was used to compare proportions between groups
**Fisher's Exact test was used to compare proportions between groups
$Others= Vaginal and Trocar Site

Table 3: Postoperative data of both groups

Parameter	Laparoscopic (n = 15)	Open (n = 15)	P-value
GIT Recovery Time/days	1.07 ± 0.1	2.76 ± 0.3	**< 0.001***
ICU Duration/days	0.13 ± 0.1	2.40 ± 0.4	**< 0.001***
Hospital stay/days	2.27 ± 0.4	7.60 ± 1.0	**< 0.001***
Chest Complication			
• **No**	14 (93.3%)	10 (66.7%)	0.084**
• **Yes**	1 (6.7%)	5 (33.3%)	
Wound Infection			
• **No**	15 (100%)	12 (80%)	0.112**
• **Yes**	0 (0%)	3 (20%)	
Postoperative Hernia			
• **No**	15 (100%)	12 (80%)	0.112**
• **Yes**	0 (0%)	3 (20%)	
DVT			
• **No**	15 (100%)	13 (86.7%)	0.143**
• **Yes**	0 (0%)	2 (13.3%)	

*Student t-test was used to compare the mean difference between groups
**Fisher's Exact test was used to compare proportions between groups

Table 4: Post operative pathological Types

Parameter	Benign (n = 30)
• **Mucinous Cystadenoma**	8 (26.7%)
• **Serous Cystadenoma**	4 (13.3%)
• **Dermoid Cyst**	4 (13.3%)
• **Borderline Serous Tumor**	3 (10%)
• **Simple Cyst**	3 (10%)
• **Endometriotic cyst**	3 (10%)
• **Ovarian Fibroma**	2 (6.7%)
• **Haemorrhagic Cyst**	1 (3.3%)
• **Sclerosing Stromal Ovarian Tumor**	1 (3.3%)
• **Struma Ovarii with Mature Teratoma**	1 (3.3%)

Postoperative Chest complications were more evident in open cases (5 cases about 33.3%) and one case (about6.7%) in laparoscopic cases without significant difference p-value= 0.084. Postoperative wound infection and postoperative incisional hernia were reported in 3 cases (20%) in conventional open cases, but no cases reported in laparoscopic cases without statistical difference. Deep venous thrombosis (DVT) was reported in two cases for open cases (13.3%) but no cases presented with DVT in laparoscopic group with p-value = 0.143.

Postoperative pathological results (Table 4) show that there are thirty cases of benign ovarian masses with different pathological types : Mucinous cystadenoma in 8 cases (26.7%), Serous cystadenoma in 4 cases (13.3%), Dermoid cysts in 4 cases (13.3%), Borderline serous tumor in 3cases (10%),Simple cysts in 3 cases (10%), Endomeriotic cyst in 3 cases (10%),Ovarian fibroma in 2 cases (6.7%) and one case (3.3%) of Hemorrhagic cyst & Sclerosing Stromal Ovarian Tumor and Struma Ovarii with Mature Teratoma**.**

Discussion:

Laparoscopic surgery is currently the first approach of choice in gynecologic adnexal surgery for both the surgeon and the patient due to its many benefits, such as decreased pain, greater cosmesis results and enhanced recovery[11]. Furthermore, following recent

advances in laparoscopic instruments, including energy devices and diverse multi-channel single-port platforms, single-incision laparoscopy has become the preferred surgical option for ovarian cystectomy to minimize postoperative scarring further[12].

Most contemporary authorities have advocated a conservative approach to laparoscopic surgery with adnexal masses in adolescents and young females[13, 14].

Several studies have reported laparoscopic surgery for patients with large ovarian cysts but the number of patients included in these reports was small. Experience related to laparoscopic surgery as a treatment modality for large ovarian masses remains limited[15-17]. This consistent with our study data as larger size of ovarian cysts were difficult to manipulate and excise with laparoscopy.

Operative laparoscopy in treating an ovarian mass provides advantages such as minimal tissue trauma, less blood loss, less perioperative discomfort, decreased hospitalization, and reduced overall cost of care[18]. Complication rates between laparoscopy and laparotomy are comparable[19] .Also in our data, these advantages of laparoscopy were evident in comparison to the laparotomy group.

Another advantage of the laparoscopic approach is the post-operative cosmetic result, which is especially important for young girls. This should be considered the decision for operative intervention in this age group[13].

Three comparative studies have reported significantly fewer postoperative complications with laparoscopy compared with laparotomy [20-22]. The following complications have been reported in the laparoscopic studies: umbilical hernias [21], retroperitoneal hematoma[22], vascular injury, lymphoceles[21, 23], obturator nerve damage[20],bowel injury or obstruction[23, 24] and ureter injury[25] . In this study, intraoperative complications were documented in two cases (13.3%) of laparoscopy as intraoperative bleeding from infundibulopelvic ligament vessels and bladder injury. Also for laparotomy cases, the intraoperative complications like ureteric injury &intraoperative bleeding and small intestinal injury in three cases (20%) with no significant statistical data (p-value= 0.524). Also, postoperative hernia and chest complications were fewer in laparoscopic cases.

Cyst rupture represents common events during surgical management of ovarian cystic masses[26]. The incidence of tumor spillage in laparoscopically managed large ovarian masses varies between 22% and 100%[27-30], whereas the risk of rupture during laparotomy has been reported to be in the range of 10% to 26%[31] .There are several techniques to prevent spillage during laparoscopy:

1) The use of grasping forceps through the five-mm port site to obliterate the puncture site and minimize spillage.

2) The removal of the specimen through a laparoscopic bag[26]. In this study cyst rupture not reported in either laparoscopic or laparotomy groups.

Conclusion:

In conclusion, our study results suggest that laparoscopic surgical treatment for benign ovarian masses is safe and adequate as the standard surgical management performed via laparotomy, and offers a shorter hospital stay and reduced morbidity, and faster GIT recovery, without increasing the risk of spillage of the cyst contents but associated with longer operation time and anaesthesia. Laparoscopy should replace laparotomy in the management of benign ovarian masses for selected cases. Small number of patients gives some limitation to this study and more prospective studies are needed for further evaluation of the feasibility of laparoscopy for benign ovarian masses.

List of abbreviations:

SECI: South Egypt Cancer Institute
SPSS: Statistical Package for the Social Sciences
EBL: Estimated blood loss
BMI: Body mass index
CT: Computed tomography
MRI: Magnetic resonance imaging
CA 125: Cancer antigen 125
AFP: Alpha-feto protein
LDH: Lactate dehydrogenase
β-HCG: Beta subunit - human chorionic gonadotrophin
LESS: Laparo-endoscopic single-site surgery
GIT: Gastrointestinal
IRB: Institutional review board
ICU: Intensive care unit
DVT: Deep venous thrombosis

Competing interests:

The authors declare that they have no conflict of interest.

Authors' Contributions:

All authors designed the study, collected the research data, analyzed the data, revised the manuscript, and approved the final version.

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