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Single-port laparoscopy *versus* conventional laparoscopy for management of benign adnexal masses during pregnancy: a comparative study

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ABSTRACT

Objective. Single-port laparoscopic surgery (SPL) is a newly developed surgical technique which was evolved from conventional laparoscopic surgery (CL). Sufficient evaluation of roles and benefits of SPL surgery for excision of adnexal masses discovered during pregnancy was not done.
Aim of the study was to compare between SPL and CL surgeries in management of benign adnexal masses during pregnancy regarding benefits, advantages, disadvantages and operative outcomes.
Patients and Methods. This retrospective cohort study included 100 patients who underwent laparoscopic adnexal surgeries during pregnancy. We divided included patients into 2 groups the first group included 50 and underwent single-port laparoscopic surgery (SPL) and the second group included 50 patients and underwent conventional laparoscopic surgery (CL).
Results. There was a statistically significant difference between both groups of patients as regard cosmetic scar satisfaction which was more in the SPL group ($p \leq 0.001$).
Operative time was longer in the SPL group of patients than in the CL group of patients with statistically significant differences ($p < 0.001$).
Conclusions. We showed that SPL was considered a feasible and safe approach for laparoscopic excision of adnexal masses during pregnancy.

INTRODUCTION

Single-port laparoscopic surgery (SPL) is a newly developed surgical technique which was evolved from conventional laparoscopic surgery (CL) [1]. SPL surgery needs a single incision in the skin, so it has a better cosmetic appearance in comparison to CL surgery. SPL surgical procedures were primarily applied for tubal sterilization that were applied in digestive, urologic and gynaecological surgeries [2]. SPL surgery was assessed in removing benign adnexal masses in comparison with CL surgery [3], but sufficient evaluation of roles and benefits of SPL surgery for excision of adnexal masses discovered during pregnancy was not done [4].
There were previously reported studies in this topic [5-7], but still concerns were found for evaluating roles of SPL surgery in management of benign adnexal masses during pregnancy [8].
When diagnosis of an adnexal mass occurred during third trimester of pregnancy, clinical management needs a multidisciplinary team to compare between malignancy risks, mass size and the health of foetus [9].

The aim of the study was to compare between SPL and CL surgeries in management of benign adnexal masses during pregnancy regarding benefits, advantages, disadvantages and operative outcomes.

PATIENTS AND METHODS

This retrospective cohort study included 100 patients who underwent laparoscopic adnexal surgeries during pregnancy at the Department of Gynecology and Obstetrics Zagazig University Hospitals in the period between October 2016 and January 2022.
We divided included patients into 2 groups the first group included 50 and underwent single-port laparoscopic surgery (SPL) and the second group included 50 patients and underwent conventional laparoscopic surgery (CL).

Inclusion criteria for the study

Pregnant patients with clinically and radiologically benign adnexal masses with a large mass (> 6-10 cm), symptomatic patients, patients with high risks of torsion or rupture of the cysts, or obstructed labour, patients with normal preoperative laboratory tests as normal complete blood count, normal electrolytes, chemistry, and coagulation profile, absence of any pregnancy or non-pregnancy-related complications were included.

Exclusion criteria

Patients with clinical or radiological evidence of malignant ovarian tumours were excluded from the study.
We acquired written informed consents from all participants written informed consent before starting the study.

Perioperative outcomes

We collected and evaluated perioperative outcomes of included patients as operative time, intra-operative blood loss, haemoglobin level changes after surgery, costs and duration of hospital stay, intraoperative and postoperative complications.
After discharging patients from the hospital, we followed them up for a period of time ranged from 6 to 12 months after the operation by telephone, to assess rate of scar satisfaction and cosmetic results. We asked patients to rate their overall satisfaction from the scar using a 10-points scale: 10 indicated very satisfied and 1 indicated very unsatisfied. Moreover, we evaluated pregnancy results and neonatal outcomes.

Surgical techniques

After general anaesthesia administration, all patients were placed in dorsal lithotomy position with supporting both legs in stirrups.
We performed a 2.5 cm umbilical incision for inserting wound retractor inner ring for fascial incision stretching, then we rolled wound retractor outer ring to connect the sealing member. Except for ports number of ports, SPL port retractor include four access ports, the surgical procedures in both SPL and CL were similar. In the SPL group, we employed an extracorporeal surgical approach as previously showed by [10].
We performed adnexal cystectomy in both included groups of patients and used endobag technique for spillage prevention [11].
In SPL for umbilical incision closure, we sutured the peritoneum, fascia then skin separately.
We continuously monitored maternal vital signs during the operations as oxygen saturation, and carbon dioxide pressure. Moreover, we performed continuous foetal sonographic monitoring for assessment of foetal heart rate pre-operative and just after the operation.

Statistical analyses

We presented data as mean, SD or by number (percentage). We analysed differences between-group of normally distributed quantitative data by using Student's t-test. We analysed quantitative data without normal distribution by using Wilcoxon rank sum test. We analysed differences between groups in qualitative data by using Fisher's exact test.
We performed all analyses using SPSS software, version 20.0 (IBM, Armonk, NY, USA) and considered a P-value < 0.05 as statistically significance value.

RESULTS

We included 100 pregnant females underwent laparoscopic surgeries for excision of benign adnexal masses. 50 patients underwent SPL (50%) and 50 patients underwent CL (50%).

We found no differences between both groups of patients as regard patient age, parity, high risk pregnancy, multiple gestation or history of caesarean section (**Table 1**).

There are no statistically significant differences between both groups as regard histopathological sub-types of the adnexal cysts that was, teratoma (29% of cysts), endometriotic cyst (20%), and serous cystadenoma (16%).

There was a statistically significant difference between both groups of patients as regard cosmetic scar satisfaction, which was more in the SPL group ($p \leq 0.001$) (**Table 2**).

We found neither complication, infection in the surgical wound nor umbilical hernia in both included groups of patients.

Table 1. *Baseline data of the studied patients.*

	n = 100	%
Parity		
P0	5	5%
P1	20	20%
P2	20	20%
P3	30	30%
P4-7	25	25%
Mode of delivery		
NVD	40	40%
CS	60	60%
Previous abdominal surgery	40	40%
Previous pelvis surgery	40	40%
SPL	50	50%
CLS	50	50%
Mass		
Cystic	29	29%
Solid	38	38%
Mixed	33	33%
Histopathology		
Endometriosis	19	19%
Functional cyst	8	8%
Mucinous cyst	26	26%
Serous cyst	26	26%
Teratoma	21	21%
Surgery		
Ovarian cystectomy	74	74%
Oophorectomy	10	10%
Salpingectomy	16	16%
	Mean ± SD	**Range**
Age (year)	34.29 ± 5.67	22-48
BMI (kg/m^2)	21.51 ± 1.83	17-25.5
Ovarian volume (cm^3)	6.71 ± 1.69	4-11
Operative time (min)	13.36 ± 2.75	9-20
Intraoperative bleeding (ml)	18.65 ± 3.35	10-28
Return of bowel function (h)	14.09 ± 2.98	9-20
Ambulation time (h)	13.51 ± 3.88	8-19
Postoperative 12-hour VAS cosmetic score	8.65 ± 1.76	5-11
Postoperative analgesic use (ampoule)	5.44 ± 1.65	3-9

Table 2. *Comparison between surgical approach and the studied parameters.*

	Approach		χ^2	P-value
	CLS	SPL		
Parity				
P0	3 (6%)	2 (4%)		
P1	11 (22%)	9 (18%)	0.683§	0.409
P2	10 (20%)	10 (20%)		
P3	15 (30%)	15 (30%)		
P4-7	11 (22%)	14 (28%)		
Mode of delivery				
NVD	17 (37%)	17 (35.4%)	0.024	0.877
CS	29 (63%)	31 (64.6%)		
Previous abdominal surgery	20 (40%)	20 (40%)	0	> 0.999
Previous pelvis surgery	22 (44%)	18 (36)	0.667	0.414
Mass				
Cystic	16 (32%)	13 (26%)	1.173	0.556
Solid	20 (40%)	18 (36%)		
Mixed	14 (28%)	19 (38%)		
Histopathology				
Endometriosis	8 (16%)	11 (22%)		
Functional cyst	5 (10%)	3 (6%)	1.175	0.882
Mucinous cyst	13 (26%)	13 (26%)		
Serous cyst	14 (28%)	12 (24%)		
Teratoma	10 (20%)	11 (22%)		
Surgery				
Ovarian cystectomy	40 (80%)	34 (68%)	2.736	0.255
Oophorectomy	5 (10%)	5 (10%)		
Salpingectomy	5 (10%)	11 (22%)		
	Mean ± SD	**Mean ± SD**	**t**	**P-value**
Age (year)	33.86 ± 4.53	33.16 ± 5.81	0.672	0.503
BMI (kg/m^2)	23.18 ± 2.74	24.98 ± 7.08	-1.676	0.098
Ovarian volume (cm^3)	7.49 ± 1.66	5.93 ± 1.34	5.179	< 0.001**
Operative time (min)	12.66 ± 3.06	15.06 ± 1.57	5.344	< 0.001**
Intraoperative bleeding (ml)	19.62 ± 2.86	17.68 ± 3.54	3.015	0.003*
Postoperative 12-hour VAS cosmetic score	7.22 ± 1.2	10.08 ± 0.8	-13.999	< 0.001**
	Median (IQR)	**Median (IQR)**	**Z**	**P-value**
Postoperative analgesic use (ampoule)	7 (5-8)	4 (4-5)	9.844	< 0.001**

§Chi square for trend test; χ^2: Chi square test; t: independent sample t test; * P-value < 0.05 is statistically significant; **P-value ≤ 0.001 is statistically highly significant; IQR: interquartile range; Z: Mann Whitney test.

Operative time was longer in the SPL group of patients than in the CL group of patients with statistically significant differences ($p < 0.001$).

There are no statistically significant differences between both groups of patients regard blood loss, haemoglobin level or duration of hospital stay.

There are no patients in both included groups required blood fusion or conversion from laparoscopy to laparotomy.

Table 3. *Partial correlation between postoperative analgesic use and studied parameters.*

	r	P-value
Operative time	0.117	0.249
Ovarian volume	-0.091	0.369
Intraoperative bleeding	-0.008	0.934
Ambulation time	-0.003	0.978
Time to return to bowel habits	0.086	0.397

r: Spearman rank correlation coefficient; P-value < 0.05 is statistically significant; **P-value ≤ 0.001 is statistically highly significant.

Included patients in both groups had a full-term delivery with no statistically significant differences in neonatal outcomes as regard APGAR scores and average birth weight.

There are no statistically significant differences between both groups of patients regard the rate of neonatal complications as jaundice, arrhythmia, hypoglycaemia, small for gestational age and respiratory distress syndrome.

After controlling approach used, there is statistically non-significant correlation between number of postoperative analgesic ampoules used and all of ovarian time, intraoperative bleeding, ovarian volume, time to return of bowel habits and ambulation time (**Table 3**).

DISCUSSION

In the present study we compared SPL and CL adnexal masses excision in pregnant females as regard operative, peri-operative outcomes, patient satisfaction, maternal and foetal outcomes. Results showed that patients who underwent SPL surgery have better cosmetic satisfaction without increased risks of adverse maternal or foetal outcomes.

Chen *et al*. [4] compared both SPL and CL in management of adnexal cystic masses in pregnant patients. They reported similar results to ours: patients who underwent adnexal surgery via SPL have better cosmetic satisfaction in comparison with patients who underwent CL approach; moreover, they showed adnexectomy via SPL makes few adverse peri-operative events and less economic burden with no increase in the adverse maternal or neonatal complications.

Similar results were demonstrated by previous studies which included non-pregnant patients and showed that SPL surgery has better cosmetic appearance and more patient satisfaction in comparison with CL surgery [12, 13].

These findings might be due to reduced abdominal incisions number that led to better patients' cosmetic requirements.

We showed that SPL surgery was associated with less postoperative pain, shorter hospital stays, and lower anxiety that was similar to results of previous studies [7, 11-14].

Due to increased connective tissue laxity and abdominal stress with progression of pregnancy [15], it was hypothesized that enlarged umbilical incision in SPL surgery might lead to increased incidence of postoperative hernia formation during pregnancy.

Closure of fascia and prolonged surgical time were associated with postoperative pain and the need for consumption of opioids. Surgical training to decrease surgical time could decrease postoperative pain and opioids [16].

Posterior colpotomy can be considered a feasible option for surgical specimens retrieval after performing laparoscopic surgeries [17].

Laparoscopic surgeries during pregnancy are safe and associated with good oncological and obstetrical outcomes [18].

In our study we do similar to Chen *et al*.'s study [4]: umbilical skin incision in patients who underwent SPL surgery were closed with simple continuous suture of the peritoneum, fascia and a separate subcuticular suture of the skin, and we reported no umbilical hernia or any complications in the umbilical incision.

Points of strength of our study

Our study was a comparative and prospective study to overcome limitations of previous retrospective studies.

Additionally, we collect data regarding postoperative pain, cosmetic and economic satisfaction.

CONCLUSIONS

In the present study we compared between SPL and CL for excision of adnexal masses in pregnancy and showed that SPL surgery provide better cosmetic satisfaction without increasing perioperative complications, or adverse maternal and neonatal outcomes.

Moreover, we showed that SPL was considered a feasible and safe approach for laparoscopic excision of adnexal masses during pregnancy.

COMPLIANCE WITH ETHICAL STANDARDS

Authors contribution

A.E.: Conceptualization. A.A-A.A.: Formal analysis. M.A.E.: Writing - original draft. O.A.H., A-R.E.A-R.: Writing - review & editing.

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Study registration

ZU-17863-2022.

Disclosure of interests

The authors declare that they have no conflict of interests.

Ethical approval

Acquired from the local institutional review board of Faculty of Medicine, Zagazig University.

Informed consent

Obtained from all included patients.

Data sharing

Data are available under reasonable request to the corresponding author.

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