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Research Article

Laparoscopic Versus Open Appendectomy during Pregnancy: Is Fetal Outcome Really Different?

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Abstract

Purpose: To assess maternal and fetal outcome of pregnant women with acute appendicitis underwent open versus laparoscopic appendectomy with emphasis on the pregnancy loss rate.

Methods: This was a retrospective review of 116 pregnant women with acute appendicitis between 2011 and 2021 in single center, who were allocated either into open appendectomy (n=68) or laparoscopic appendectomy (n=48). Maternal and fetal outcome was recorded, tabulated and statistically analyzed.

Results: There was no significant difference between both groups in terms of the rates of abortion [p>0.05, OR (CI 95%) 1.47 (0.42-5.18)], intrauterine fetal demise [p>0.05, OR (CI 95%) 0.94(0.2-4.39)], preterm delivery [p>0.05, OR (CI 95%) 1.9(0.56-6.45)], placental abruption [p>0.05, OR (CI 95%) 2.23(0.43-11.53)], mode of delivery (p>0.05) and neonatal admission to NICU (p>0.05). There was no significant difference between both groups regarding perioperative data in terms of duration of symptoms before attending the hospital, final diagnosis, postoperative fever, re-operation, thromboembolism, surgical site infection and histopathology results (p>0.05). Laparoscopic appendectomy was associated with shorter operative time (p<0.05), shorter time for return of bowel motility (p<0.001) and shorter hospital stay (p<0.05).

Conclusion: Laparoscopic appendectomy is safe, feasible and minimally-invasive surgery during pregnancy and not associated with increased pregnancy loss when performed under strict criteria. Larger trials are warranted to confirm or refute these findings.

Keywords: Acute appendicitis during pregnancy; Laparoscopy; Appendectomy; Maternal outcome; Fetal outcome

Introduction

Acute appendicitis is the commonest non-obstetric surgical emergency occurring during pregnancy with reported rate of 25%, and variable incidence of one in every 500 to 2000 pregnancies (0.04 % and 0.2 %) [1-4].

The reported rate of appendiceal perforation during pregnancy can be as high as 43%, compared with only 19% in the general population. Complicated appendicitis is associated with poor obstetric outcome, such as fetal loss; thus, patients with acute appendicitis during pregnancy should immediately undergo appendectomy [4,5].

Although laparoscopy is associated with less pain, shorter hospital stay and fewer wound infections than the open approach, Open Appendectomy (OA) is still recommended for pregnant patients over Laparoscopic Appendectomy (LA), which might be associated with higher rates of fetal loss [6-8].

A recent systematic review and meta-analysis reported, it is not reasonable to conclude that LA in pregnant women might be associated with a greater risk of fetal loss as the difference between LA and OA with respect to preterm delivery was not significant [9].

The aim of this study was to assess maternal and fetal outcome of pregnant women with acute appendicitis underwent open versus laparoscopic appendectomy with emphasis on the pregnancy loss rate.

Materials and Methods

This retrospective analysis was conducted at the department of General Surgery in collaboration with the Obstetrics and Gynecology department at Rabia Hospital, Riyadh, Saudi Arabia.

Medical records of pregnant women diagnosed with acute appendicitis during the period between the beginnings of August 2011 and August 2021were reviewed.

Diagnosis was accomplished after complete history taking, full clinical examination, laboratory testing and ultrasound examination were enrolled. Clinical criteria for diagnosis included acute abdominal pain started as diffuse then settled in the right iliac fossa, associated with one or more of the followings; anorexia, nausea, vomiting, constipation, fever (≥ 38° C), tenderness in the right iliac fossa and rebound tenderness [10]. Complete blood count with Total Leucocytic Count (TLC) above 16,000/mm^3 [11]. Further imaging modalities as C.T. scan and MRI were not preformed secondary to their higher cost and non-availability.

Ultrasound criteria included the identification of a non-compressible, blind-ended tubular structure localized at the lower

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right quadrant of the abdomen, with a maximal diameter exceeding 6 mm, round configuration in the transverse section (Target sign), increased echogenicity of the peri-appendiceal fat with fluid collection and hypervascularization of the appendix on color Doppler study [12,13].

Complicated appendicitis was diagnosed in patients with appendicular mass or abscess, appendicular perforation or with signs of peritonitis.

Patients presented with fetal demise, abnormal vaginal bleeding, having history of bleeding tendency; were excluded from the analysis.

Included patients were designated either to laparoscopic or open approach based on the patient preference as most of the included patients were not covered by health insurance with laparoscopic route at our hospital was more costly (about double expenses) compared to laparotomy. The study included 116 patients who were divided into two groups:

Group 1 (open appendectomy group): included 68 pregnant patients with acute appendicitis.

Group 2 (Laparoscopic appendectomy): included 48 pregnant patients with acute appendicitis.

Open appendectomy was performed either via Mc Burney or Midline incision under regional or general anesthesia based on the clinical circumstances.

Laparoscopic appendectomy was performed under general anesthesia with the Hasson open technique was used to gain initial abdominal access and CO_2 pneumoperitoneum was achieved at the maximal intra-abdominal pressure between 10–12 mm Hg throughout the operation.

All patients received antibiotic coverage and tocolytic therapy in the form of Indomethacin 100 mg rectal suppositories every 12 hours started half an hour before surgery and maintained for 2-5 days according to patients' need for analgesia.

Histopathology was performed to determine the type of pathology (normal appendix, focal appendicitis, suppurative appendicitis or gangrenous appendicitis).

Following surgery, routine antenatal care visits data till the end of puerperium and Obstetric (maternal and fetal) outcome was recorded.

Outcome Measures

Maternal outcome: operative details (including type of anesthesia, operative time, need for drain) and postoperative outcome as fever, time to first flatus, wound infection, re-exploration, thromboembolism and length of hospital stay), abortion (pregnancy loss prior to 20 weeks' gestation), preterm delivery (defined as delivery before completed 37 weeks) and mode of delivery.

Fetal-neonatal outcome: intrauterine fetal demise, prematurity and admission to Neonatal Intensive Care Unit (NICU) and neonatal death (defined as death during the first 28 days after birth).

Statistical Analysis

Statistical analysis was performed using Statistical Package for the Social Sciences Version 16 (IBM Corp., Armonk, NY, USA).

Quantitative data were expressed as means and standard deviations. Chi-squared test and t-test were used to compare the two groups as indicated. P value > 0.05 was non-significant, $p \leq 0.05$ was significant and $p \leq 0.001$ was considered highly significant.

Results

There was no significant difference between both groups regarding maternal demographic data in terms of age, parity, body mass index, history of previous cesarean delivery and gestational age in relation to pregnancy trimester (p>0.05) as depicted in (Table 1).

There was no significant difference between both groups regarding perioperative data in terms of duration of symptoms before attending the hospital, final diagnosis, postoperative fever, re-operation, thromboembolism, surgical site infection and histopathology results (p>0.05). Laparoscopic appendectomy was associated with shorter operative time (p<0.05), shorter time for return of bowel motility (p<0.001) and shorter hospital stay (p<0.05) as revealed in (Table 2).

Regarding obstetric outcome, there was no significant difference between both groups in terms of the rates of abortion [p>0.05, OR (CI 95%) 1.47 (0.42-5.18)], intrauterine fetal demise [p>0.05, OR (CI 95%) 0.94(0.2-4.39)], preterm delivery [p>0.05, OR (CI 95%) 1.9(0.56-6.45)], placental abruption [p>0.05, OR (CI 95%) 2.23(0.43-11.53)], mode of delivery (p>0.05) and neonatal admission to NICU (p>0.05) as shown in (Table 3).

Table 4 reveals no significant difference between both groups regarding contributing factors to pregnancy loss in terms of duration of the symptoms before surgery, gestational age and histopathology

Table 1: Maternal demographic data.

	Open appendectomy (n=68)	Laparoscopic appendectomy (n=48)	Student t-test	P-value
Age (years)	24.21±6.11	23.96±6.74	0.21	>0.05
Parity	2.82±0.92	2.42±1.26	1.98	>0.05
Body mass index (Kg/m²)	25.11±4.86	25.58±4.22	0.54	>0.05
Previous cesarean deliveries	12	8	0.01*	>0.05
Gestational age				
-First trimester	28	18	0.04*	>0.05
-Second trimester	32	26	0.32*	>0.05
-Third trimester	8	4	0.08*	>0.05

*Chi square test.

Table 2: Perioperative data.

	Open appendectomy (n=68)	Laparoscopic appendectomy (n=48)	Chi square test	P-value
Duration of symptoms:				
-Less than 24 hours.	54	40	0.08	>0.05
-More than 24 hours.	14	8		
Final diagnosis:				
-Uncomplicated appendicitis.	40	32	0.44	>0.05
-Complicated appendicitis.	28	16		
Operation time (minutes)	42.86±18.44	35.32±15.62	2.31*	<0.05
Time to first flatus (hours)	46.28±10.56	32.16±8.28	7.73*	<0.001
Reoperation	0	0	-	-
Fever	14	5	1.45	>0.05
Thromboembolism	2	1	0.09	>0.05
Length of hospital stay (days)	3.24±1.88	2.32±1.62	2.75*	<0.05
Surgical site infection	8	2	1.21	>0.05
Histopathology:				
-Normal appendix.	0	1	0.03	>0.05
-Focal appendicitis	28	16	0.44	>0.05
-Suppurative appendicitis.	34	30	1.31	>0.05
-Gangrenous appendicitis	6	1	1.22	>0.05

*Student t-test.

Table 3: Obstetric outcome.

	Open appendectomy (n=68)	Laparoscopic appendectomy (n=48)	Chi square test	P-value	OR (CI 95%)
Abortion (before 20 weeks')	8	4	0.08	>0.05	1.47 (0.42-5.18)
Fetal demise (after 20 weeks')	4	3	0.1	>0.05	0.94 (0.2-4.39)
Preterm delivery	10	4	0.56	>0.05	1.9 (0.56-6.45)
Placental abruption	6	2	0.36	>0.05	2.23 (0.43-11.53)
Mode of delivery:					
-Vaginal delivery.	40	26	0.1	>0.05	1.21 (0.57-2.55)
-Cesarean section.	20	18			
NICU admission	8	2	1.21	>0.05	3.07 (0.62-15.13)
Neonatal death	0	0	-	-	-

OR=Odd ration, CI 95%=Confidence interval at 95%.

Table 4: Pregnancy loss cases.

	Open appendectomy (n=12)	Laparoscopic appendectomy (n=7)	Chi square test	P-value
Duration of symptoms > 24 hours	10	6	0.27	>0.05
Gestational age				
-First trimester	8	4	0.01	>0.05
-Second trimester	1	2	0.27	>0.05
-Third trimester	3	1	0.001	>0.05
Histopathology:				
-Suppurative appendicitis.	7	6	0.53	>0.05
-Gangrenous appendicitis	5	1		

results (p>0.05).

Discussion

The current study revealed absence of increased risk of pregnancy loss in patients with acute appendicitis underwent laparoscopic appendectomy compared to open appendectomy regardless of the pregnancy trimester, delayed hospital attendance the presence of complications or the type of pathology.

A recent systematic review and meta-analysis included 22 comparative cohort studies, which involved 4694 women, of whom 905 underwent LAs and 3789 underwent OAs. The sensitivity analysis showed that the effect size was influenced by one of the studies, because its removal resulted in there being no significant difference between LA and OA with respect to the risk of fetal loss (OR 1.163, 95% CI: 0.68–1.99; P = 0.581). In addition, the difference between LA and OA with respect to preterm delivery was not significant [9].

Laparoscopic appendectomy in this study was associated with shorter operative time, rapid recovery of bowel function and shorter hospital stay compared to open appendectomy; which are in agreement to previous trials [14-16].

Laparoscopic appendectomy in pregnant women appears to be an effective technique in all trimesters of pregnancy, providing the benefits of minimally invasive surgery [17-19].

On the contrary other studies and reviews concluded higher rate of fetal loss in LA which cannot be ignored and should be discussed carefully during counseling of pregnant patients with acute appendicitis [20-22].

Contributing factors to pregnancy loss after laparoscopic appendectomy included the use of heterogeneous drugs, pneumoperitoneum under high pressure interfering with uterine blood flow and increasing the likelihood of fetal acidosis, lengthy operative time more than one hour as well as the risk of uterine injury by laparoscopic instruments [23,24].

In this study, laparoscopic appendectomy was performed by Hasson open technique with intra-abdominal pressure maintained at 10-12 mmHg with operative time not exceeding 60 minutes even in complicated cases. In addition, only four patients in the third trimester underwent LA which could explain the absence of major complications.

The larger cohort included, single operator and the lower drop out cases rate, constitute the main strengths of the current study.

Inability to conduct a randomized trial and to include larger number of patients in the third trimester were unintended limitations of this study as the highest incidence of acute appendicitis occurs in the second trimester and most of our patients cannot afford for laparoscopy.

Inability to perform further imaging as CT and MRI to confirm appendicitis during pregnancy secondary to their higher cost and non-availability at our hospital, constitutes another unintended limitation. Although, both imaging modalities are necessary only in doubtful cases and in patients with atypical clinical presentations [25-27].

Future research should explore the cost-effectiveness as well as the true pregnancy loss rate (abortion rate and preterm delivery rat) in larger trials.

Conclusion

Laparoscopic appendectomy is safe, feasible and minimally-invasive surgery during pregnancy and not associated with increased pregnancy loss when performed under strict criteria. Larger trials are warranted to confirm or refute these findings.

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Disclosure

The authors declare that there is no conflict of interest associated with this manuscript.

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