

## Comparison of Laparoscopy and Laparotomy for Non-Obstetric Surgeries in Pregnancy Concerning Maternal and Fetal Outcomes

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### Abstract

**Background:** The associated risks with pregnancy surgeries are markedly reduced with laparoscopy and using advanced neonatal care units in hospitals and with pre-operative and post-operative intensive care of the female. **Aims:** The present trial was carried out to assess if laparoscopy in pregnancy is as beneficial compared to open surgery as in non-pregnant subjects including a reduction in surgical time, postoperative infection, and hospital-stay peri-operatively. **Materials and Methods:** In 48 females, admission for surgery, age, gravid status, twins/single fetus, age of gestation, surgery type, weight, age, hospital stay, intraoperative time and complications, contraction, post-operative complications, time of delivery, and readmissions to the hospital from surgery till delivery. Fetal outcomes: fetal age at delivery, weight at birth, sex, congenital malformations, hospital stay, and perinatal death. The data collected were subjected to statistical evaluation. **Results:** The results were significant concerning the mean length of stay in the hospital which was  $3.8 \pm 3.7$  for laparoscopy and was  $5.4 \pm 3.3$  for open surgery with a p-value of 0.1207. The time from surgery to delivery for laparoscopy was more with the mean value of  $22.1 \pm 8.21$  with the p-value of 0.0138 which was statistically significant. Post-operative complications were also lesser in the laparoscopic group with 17.6% in laparoscopy and 47.6% in laparotomy.

**Conclusion:** The present study concludes that laparoscopy performed for non-obstetric procedures has superior results compared to open surgery in terms of maternal and fetal outcomes irrespective of the gestational age of delivery, intra-operative time, and fetal death.

**Keywords:** Laparoscopy, laparotomy, maternal outcome, fetal outcomes, pregnancy surgery, non-obstetric surgery

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### Introduction

Various surgical procedures are performed during the pregnancy to relieve the pregnant females from diseases in maternity and to simultaneously reduce the harm to the developing fetus. The acute diseases requiring surgical intervention, when encountered during pregnancy increase the rate of mortality in fetus and mother. Also, these diseases drastically affect fetal and maternal outcomes post-pregnancy. However, before the treatment plan for such cases is made (requiring abdominal surgeries), the risk-benefit ratio for mother and fetus should be carefully weighed. Despite the risk involved, maternal outcome and health are given priority, as the health of the fetus depends on maternal condition. The associated risks are markedly reduced with advanced neonatal care units in hospitals and with pre-operative and post-operative intensive care of the female. Irrespective of the advances in medical care, extreme caution should be practiced for any surgical procedure carried out in pregnancy[1-3]. The conditions requiring immediate surgical interventions during pregnancy include various abdominal conditions such as an obstruction in the bowel, appendicitis, and/or cholecystitis. Other

such conditions can be a miscarriage, ligament stretch, ectopic pregnancy, and/or abruption of the placenta.<sup>4</sup> Although, prompt and appropriate diagnosis and intervention have positive outcomes for both fetus and female, pregnancy itself hinders this accuracy owing to various changes in the body during pregnancy. These include muscle laxity masking peritoneal signs, appendix displacement, and physiologic leucocytosis[5]. Surgeries performed during pregnancy are rare with an incidence of as low as 1 in 833 pregnant females and are postponed usually till childbirth. Abdominal surgeries account majorly for the surgeries performed during pregnancy accounting for approximately 25% of surgeries[6]. These include obstruction in the intestine, cholecystectomy, and/or appendectomy. Surgeries in the first trimester can lead to fetalalteratogenesis and abortion and are hence avoided. Surgeries during the third-trimester result in preterm birth, and so the surgeries are preferred during the second trimester with the least risks[7]. Laparoscopic surgeries in pregnancy were initially used for heterotropic and ectopic pregnancy detection. However, later laparoscopic surgeries were also employed for bowel resection, hernia repair, adhesion lysis, adrenalectomy, liver biopsies, splenectomy, lymphadenectomy, cholecystectomy, nephrectomy, and/or appendectomy. Laparoscopic surgeries are also used to diagnose various conditions as they are carried out with minimal effect on the uterus, and hence, result in fewer post-operative complications including abortions, and pre-term births. Appendectomy and cholecystectomy remain the two most common surgeries performed during pregnancy[8,9]

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Hence, the present trial was carried out to assess if laparoscopy in pregnancy is as beneficial compared to open surgery as in non-pregnant subjects including a reduction in surgical time, postoperative infection, and hospital-stay peri-operatively. Also, post-surgical outcomes both maternal and fetal were assessed in laparoscopic surgeries over appendectomy, laparotomy, and cholecystectomy in terms of teratogenicity, abortions, perinatal deaths, stillbirths, birth weight, and fetal age at the time of delivery.

#### Material and Methods

The present trial was carried out to assess if laparoscopy in pregnancy is as beneficial compared to open surgery as in non-pregnant subjects including a reduction in surgical time, postoperative infection, and hospital-stay peri-operatively. Also, post-surgical outcomes both maternal and fetal were assessed in laparoscopic surgeries over appendectomy, laparotomy, and cholecystectomy in terms of teratogenicity, abortions, perinatal deaths, stillbirths, birth weight, and fetal age at the time of delivery.

The data regarding the females who underwent surgeries during their pregnancy was collected from the medical records of the institute. The included subjects had surgeries for the spleen, gastrointestinal tract, and/or endocrine systems. A total of 48 females were included finally in the study who met the criteria for inclusion. The included subjects were 48 females within the age group of 22 years to 34 years with a mean age of 23.1 years. Ethical clearance was taken from the Ethical committee of the institute. The exclusion criteria for the study included the surgeries performed for the obstetrician issues such as abdomen cerclage, medical issues, ectopic pregnancies, ovarian cyst removal, non-intra-abdominal surgeries such as open surgeries for hernia (inguinal/umbilical), and open cholecystectomy. Parameters regarding maternal status extracted from the records included admission for surgery, age, gravid status, twins/single fetus, age of gestation, surgery type, weight, age, hospital stay, intraoperative time and complications, contraction, post-operative complications, time of delivery, and readmissions to the hospital from surgery till delivery. Regarding fetal outcomes fetal age at delivery, weight at birth, sex, congenital malformations, hospital stay, perinatal death, and respiration were assessed. Concerning maternal outcomes, parameters extracted were: fetal loss either from abortion (therapeutic/accidental), or stillbirths, vaginal deliveries, cesarean deliveries, and labor induction in applicable cases were evaluated.

The data collected were subjected to the statistical evaluation with statistical significance was kept at  $p$ -value  $< 0.05$ .

#### Results

The present trial was carried out to assess if laparoscopy in pregnancy is as beneficial compared to open surgery as in non-pregnant subjects including a reduction in surgical time, postoperative infection, and hospital-stay peri-operatively. Also, post-surgical outcomes both maternal and fetal were assessed in laparoscopic surgeries over appendectomy, laparotomy, and cholecystectomy in terms of teratogenicity, abortions, perinatal deaths, stillbirths, birth weight, and fetal age at the time of delivery.

The included subjects were 48 females within the age group of 22 years to 34 years with a mean age of 23.1 years. For all included 48 females, laparotomy and laparoscopy were compared for various fetal and maternal outcomes and results are depicted in Table 1. The results showed that there was a significant difference in the maternal and fetal outcomes in laparoscopic and laparotomy surgeries. The results were significant concerning the mean length of stay in the hospital which was  $3.8 \pm 3.7$  for laparoscopy and was  $5.4 \pm 3.3$  for open surgery with a  $p$ -value of 0.1207. The time from surgery to delivery and birth weight of infants also showed a significant difference in laparoscopy and laparotomy. The time from surgery to delivery for laparoscopy was more with the mean value of  $22.1 \pm 8.21$  and for open surgery, it was  $15.5 \pm 9.6$  with the  $p$ -value of 0.0138 which was statistically significant. The infant weight at birth was significantly higher in the laparoscopy group with the mean value of  $3.32 \pm 0.62$  and was lower for laparotomy with  $2.91 \pm 0.74$  kg with a  $p$ -value of

0.031. Post-operative complications were also lesser in the laparoscopic group with 17.6% in laparoscopy and 47.6% in laparotomy. Also, post-operative contractions were lower in pregnant females treated by laparoscopy with only 2.2% of subjects having contractions, whereas, 19.1% of subjects in the laparotomy group were found to have post-operative contractions.

Regarding the commonly performed surgery in pregnant females, cholecystectomy, there was a difference in the various maternal and fetal parameters assessed. However, a significant difference was seen only about the post-operative stay at the hospital which was significantly lower in the laparoscopic cholecystectomy compared to the open cholecystectomy (Table 2). The mean hospital stay for laparoscopic cholecystectomy was  $4.7 \pm 4.6$  days, whereas, in open cholecystectomy, this stay was  $6.5 \pm 2.3$  days with the  $p$ -value of 0.0931 which was statistically significant. Although, the differences were also seen concerning other maternal and fetal outcomes including surgical time, time from surgery to delivery, infant weight at birth, perioperative complications, and contractions with laparoscopic cholecystectomy showing better results. However, these differences were statistically non-significant. The study also compared maternal and fetal outcomes in laparoscopic and open appendectomy and the results favored laparoscopy over open appendectomy (Table 3). The significant difference was seen with a total stay in the hospital, the time between surgery to delivery, and intra-operative complications with laparoscopy showing better results compared to open appendectomy. Meantime for a hospital stay in laparoscopic appendectomy was  $2.3 \pm 1.2$  days compared to  $5.1 \pm 3.3$  days for open appendectomy with a significant  $p$ -value of 0.00003. Time from surgery to delivery was significantly lower for laparotomy with  $15.7 \pm 9.6$  weeks and for laparoscopy, this was  $24.5 \pm 7.7$  ( $p$ -value 0.4863). Intra-operative complications were encountered in 2.6% of study subjects for laparotomy and no-complication was seen in the laparoscopic group. Other maternal and fetal outcomes were also showed better results in laparoscopic appendectomy as shown in Table 3. However, the difference was not statistically significant.

#### Discussion

The present trial was carried out to assess if laparoscopy in pregnancy is as beneficial compared to open surgery as in non-pregnant subjects including a reduction in surgical time, postoperative infection, and hospital-stay peri-operatively. Also, post-surgical outcomes both maternal and fetal were assessed in laparoscopic surgeries over appendectomy, laparotomy, and cholecystectomy in terms of teratogenicity, abortions, perinatal deaths, stillbirths, birth weight, and fetal age at the time of delivery.

The results showed that laparoscopy performed for non-obstetric procedures has several advantages in comparison to open surgery in terms of maternal and fetal outcomes. On comparing the laparotomy and laparoscopy, the results were significant concerning the mean length of stay in the hospital which was  $3.8 \pm 3.7$  days for laparoscopy and was  $5.4 \pm 3.3$  days ( $p$ -value=0.1207). The time from surgery to delivery for laparoscopy was more with the mean value of  $22.1 \pm 8.21$  and for open surgery, it was  $15.5 \pm 9.6$  ( $p$ -value=0.0138) which was statistically significant. The infant weight at birth was significantly higher in the laparoscopy group with the mean value of  $3.32 \pm 0.62$  and was lower for laparotomy with  $2.91 \pm 0.74$  kg ( $p$ -value=0.031). Post-operative complications were also lesser in the laparoscopic group with 17.6% in laparoscopy and 47.6% in laparotomy. Also, post-operative contractions were lower in pregnant females treated by laparoscopy with only 2.2% of subjects having contractions, whereas, 19.1% of subjects in the laparotomy group were found to have post-operative contractions. These findings were in agreement with the study by Griffiths J et al [10] in 2005 where post-operative contractions were 19.3% in open surgery compared to 2.2% in laparoscopy. Also, Rizzo A.G et al [11] in 2003 reported low birth weight in infants after open surgery compared to laparoscopy.

For cholecystectomy, the significant difference was seen only concerning the post-operative stay at the hospital which was significantly lower in the laparoscopic cholecystectomy compared to the open cholecystectomy. The mean hospital stay for laparoscopic cholecystectomy was  $4.7\pm 4.6$  days, whereas, in open cholecystectomy, this stay was  $6.5\pm 2.3$  days with the p-value of 0.0931 which was statistically significant. Although, the differences were also seen concerning other maternal and fetal outcomes including surgical time, time from surgery to delivery, infant weight at birth, perioperative complications, and contractions with laparoscopic cholecystectomy showing better results. However, these differences were statistically non-significant. Palanivelu C et al<sup>12</sup> in 2007 reported results similar to the present study concerning laparoscopic cholecystectomy showing less hospital stay duration. Also, Oelsner G et al<sup>13</sup> in 2003 compared long-term outcomes on surgeries done either laparoscopic or laparotomy on pregnant females and showed better results in laparoscopy compared to laparotomy.

For appendectomy, significant differences were seen with a total stay in the hospital, the time between surgery to delivery, and intra-operative complications with laparoscopy showing better results compared to open appendectomy. The mean time for a hospital stay in laparoscopic appendectomy was  $2.3\pm 1.2$  days compared to  $5.1\pm 3.3$  days for open appendectomy with a significant p-value of 0.00003.

Time from surgery to delivery was significantly lower for laparotomy with  $15.7\pm 9.6$  weeks and for laparoscopy, this was  $24.5\pm 7.7$  (p-value 0.4863). Intra-operative complications were encountered in 2.6% of study subjects for laparotomy and no-complication was seen in the laparoscopic group. Other maternal and fetal outcomes were also showed better results in laparoscopic appendectomy. However, the differences were not statistically significant. These findings were in agreement with the studies of O'Rourke and Kodali BS in 2006, and by Carver TW et al [15] in 2005 where authors reported superior outcomes in pregnant females treated surgically for appendicitis with laparoscopy compared to the open surgery<sup>14</sup>

#### Conclusion

The present study concludes that laparoscopy performed for non-obstetric procedures has superior results compared to open surgery in terms of maternal and fetal outcomes irrespective of the gestational age of delivery, intra-operative time, and fetal death. The main benefit of laparoscopy was a lesser stay at the hospital, which has advantages in terms of economy and fewer chances of hospital-acquired infections which can affect both fetuses and females carrying it. Also, lesser perioperative complications were associated with laparoscopy. However, the study had a few biases and limitations including small sample size.

**Table 1: Laparoscopy versus laparotomy during pregnancy as it relates to maternal and fetal outcomes**

S. No	Parameter	Laparoscopy	Laparotomy	p-value
1.	Age range	22-34 years	24-33 years	-
2.	Mean age (in years)	23.2 years	25.1 years	-
3.	Fetal age at surgery	$16.3\pm 7.4$	$21.2\pm 8.2$	0.0349
4.	Hospital stay	$3.8\pm 3.7$	$5.4\pm 3.3$	0.1207
5.	Surgical time (in minutes)	$86.2\pm 47.2$	$80.2\pm 32.6$	0.6108
6.	Mean time from surgery to childbirth	$22.1\pm 8.21$	$15.5\pm 9.6$	0.0138
7.	Fetal age at delivery	$38.7\pm 2.2$	$37.5\pm 5.1$	0.2954
8.	Vaginal delivery	58.6%	79.7%	-
9.	Caesarean Delivery	41.4%	20.3%	-
10.	Preterm deliveries	12.1%	20.2%	-
11.	Weight at birth (in kg)	$3.32\pm 0.62$	$2.91\pm 0.74$	0.0431
12.	Low birth weights	3.2%	16.1%	-
13.	Complications during surgery	2.4%	5.5%	-
14.	Post-operative complications	17.6%	47.6%	-
15.	Contractions after surgery	2.2%	19.1%	-

**Table 2: Laparoscopic versus open cholecystectomy during pregnancy as it relates to maternal and fetal outcomes**

S. No	Parameter	Laparoscopy	Laparotomy	p-value
1.	Age at maternity	$25.5\pm 5.7$	$26.1\pm 6.2$	0.7287
2.	Body Mass Index	$30.9\pm 10.2$	$31.2\pm 6.17$	0.9024
3.	Fetal age at surgery	$19.3\pm 6.4$	$24.6\pm 6.3$	0.0058
4.	Hospital stay	$4.7\pm 4.6$	$6.5\pm 2.3$	0.0931
5.	Surgical time (in minutes)	$100.6\pm 44.4$	$108.4\pm 19.6$	0.4351
6.	Mean time from surgery to childbirth	$19.8\pm 7.7$	$14.2\pm 8.6$	0.0217
7.	Fetal age at delivery	$38.7\pm 1.8$	$38.3\pm 2.6$	0.5385
8.	Vaginal delivery	62.4%	61.7%	-
9.	Caesarean Delivery	37.6%	38.3%	-
10.	Preterm deliveries	5.28%	20.2%	-
11.	Weight at birth (in kg)	$3.3\pm 0.57$	$3.1\pm 0.53$	0.2144
12.	Low birth weights	0%	0%	-
13.	Complications during surgery	4.1%	20.6%	-
14.	Post-operative complications	24.3%	40.5%	-
15.	Contractions after surgery	4.1%	20.6%	-

**Table 3: Laparoscopic versus open appendectomy during pregnancy as it relates to maternal and fetal outcomes**

S. No	Parameter	Laparoscopy	Laparotomy	p-value
16.	Age at maternity	26.3±4.7	26.6±6.9	0.8610
17.	Body Mass Index	28.6±4.5	27.6±5.6	0.4987
18.	Fetal age at surgery	12.5±7.4	20.7±8.3	0.0007
19.	Hospital stay	2.3±1.2	5.1±3.3	0.0003
20.	Surgical time (in minutes)	68.2±30.7	74.4±30.5	0.4863
21.	Mean time from surgery to childbirth	24.5±7.7	15.7±9.6	0.0010
22.	Fetal age at delivery	37.7±3.2	37.3±5.4	0.7563
23.	Vaginal delivery	54.4%	77.7%	-
24.	Caesarean Delivery	45.6%	22.3%	-
25.	Preterm deliveries	18.1%	20.1%	-
26.	Weight at birth (in kg)	3.1±0.82	2.8±0.82	0.2114
27.	Low birth weights	9.2%	17.7%	-
28.	Complications during surgery	0%	2.6%	-
29.	Post-operative complications	7.3%	45.7%	-
30.	Contractions after surgery	0%	16.2%	-

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