

Treatment Outcomes of Ectopic Pregnancy by Laparoscopy vs Laparotomy: a Retrospective Cohort Study

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Abstract

Objectives: To compare the type of tubal operative procedure, operative time, and postoperative outcomes in patients undergoing laparoscopic surgery versus laparotomy for the treatment of ectopic pregnancy.

Methods: A retrospective cohort study was conducted in patients who had ectopic pregnancy and were treated in Faculty of Medicine Vajira Hospital from 1 January 2005 to 31 December 2009. Ninety-eight patients were recruited into the study. Of these, 49 patients were treated by laparoscopic surgery and 49 by laparotomy. Demographic and operative data were collected from the medical records and were compared between the two groups.

Results: Salpingostomy was more commonly performed in the laparoscopic group (55.1%) while salpingectomy was the main procedure in the laparotomy group (63.3%). Operative time was longer by laparoscopic approach compared to laparotomy (115.3 ± 20.2 mins vs 67.1 ± 14.4 mins, p -value < 0.001). Lower visual analogue postoperative pain score (2.4 ± 1.2 vs 6.0 ± 1.0 , p -value < 0.001), less postoperative analgesics requirement in the first 24 hours (1.2 ± 1.0 doses vs 4.0 ± 1.0 doses, p -value < 0.001), and shorter hospital stay (2.1 ± 0.3 days vs 3.5 ± 0.4 days, p -value < 0.001) were found in laparoscopic surgery group in comparison to those in the laparotomy group.

Conclusion: Tubal preservative procedure was done more frequently in the laparoscopic group. Laparoscopy has benefits over laparotomy in terms of lower postoperative pain score, less needed for analgesics, and shorter hospital stay.

Keywords: ectopic pregnancy, laparoscopic surgery, laparotomy, salpingostomy, salpingectomy

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บทคัดย่อ

ผลของการผ่าตัดส่องกล้องและการผ่าตัดเปิดช่องท้องในการรักษาภาวะตั้งครรภ์นอกโพรงมดลูก

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วัตถุประสงค์: เพื่อเปรียบเทียบชนิดของการผ่าตัด ระยะเวลาในการผ่าตัด และผลของการผ่าตัดส่องกล้องและการผ่าตัดเปิดหน้าท้อง ในการรักษาการตั้งครรภ์นอกโพรงมดลูก

วิธีดำเนินการวิจัย: การวิจัยนี้เป็นการวิจัยแบบเก็บข้อมูลย้อนหลังจากแฟ้มประวัติของหญิงตั้งครรภ์ที่ได้รับการวินิจฉัยภาวะตั้งครรภ์นอกโพรงมดลูกซึ่งได้รับการรักษาโดยการผ่าตัด ณ คณะแพทยศาสตร์วชิรพยาบาล ตั้งแต่ 1 มกราคม พ.ศ. 2548 จนถึง 31 ธันวาคม พ.ศ. 2552 จำนวน 98 ราย (49 รายได้รับการผ่าตัดส่องกล้องทางหน้าท้อง และ 49 รายได้รับการผ่าตัดแบบเปิดหน้าท้อง) ผู้ป่วยที่ได้รับการผ่าตัดส่องกล้องทางหน้าท้องต้องมีสัญญาณชีพปกติ ทำการเก็บข้อมูลทั่วไป และข้อมูลเกี่ยวกับการผ่าตัดจากเวชระเบียนผู้ป่วยในและนำมาเปรียบเทียบระหว่างสองกลุ่ม

ผลการวิจัย: ในการผ่าตัดส่องกล้องทางหน้าท้อง ใช้วิธีการผ่าตัดแบบ salpingostomy มากที่สุด (ร้อยละ 55.1) ขณะที่การผ่าตัดเปิดหน้าท้องใช้วิธีการผ่าตัดแบบ salpingectomy มากที่สุด (ร้อยละ 63.3) การผ่าตัดส่องกล้องใช้เวลานานกว่าการผ่าตัดเปิดหน้าท้อง (115.3 ± 20.2 นาที และ 67.1 ± 14.4 นาที, $p\text{-value} < 0.001$) มีระดับความเจ็บปวดหลังผ่าตัดน้อยกว่า (2.4 ± 1.2 และ 6.0 ± 1.0 , $p\text{-value} < 0.001$) และมีจำนวนครั้งของการต้องการยาแก้ปวดหลังผ่าตัด 24 ชั่วโมงแรกน้อยกว่า (1.2 ± 1.0 และ 4.0 ± 1.0 , $p\text{-value} < 0.001$) นอกจากนี้พบว่าผู้ป่วยที่ได้รับการผ่าตัดส่องกล้องมีระยะเวลาในการนอนโรงพยาบาลหลังการผ่าตัดสั้นกว่าผู้ป่วยที่ได้รับการผ่าตัดเปิดหน้าท้อง (2.1 ± 0.3 วัน และ 3.5 ± 0.4 วัน, $p\text{-value} < 0.001$)

สรุป: ผู้ป่วยที่ผ่าตัดส่องกล้อง ได้รับการผ่าตัดแบบ salpingostomy มากกว่าผู้ป่วยที่ผ่าตัดเปิดหน้าท้อง ผู้ป่วยที่ผ่าตัดส่องกล้องมีระดับความเจ็บปวดหลังผ่าตัดน้อยกว่า ความต้องการยาแก้ปวดหลังผ่าตัด 24 ชั่วโมงแรกน้อยกว่า และระยะเวลาในการนอนโรงพยาบาลหลังผ่าตัดสั้นกว่าผู้ป่วยที่ได้รับการผ่าตัดเปิดหน้าท้อง

Introduction

The incidence of ectopic pregnancy has increased all over the world from 5 per 1000 pregnancies during the past three decades to almost 20 per 1000 pregnancies at present.^{1,2} An emerging technique of assisted reproductive technology, which was found to increase risk of ectopic pregnancy by 5%, is one possible reason for such a steep rise in the incidence.²

Ectopic pregnancy is one of major pregnancy complications which can cause not only fetal loss but also increase in maternal morbidity and mortality.^{3,4} Delayed diagnosis of ectopic pregnancy may result in rupture and acute blood loss. Massive blood loss from ectopic mass accounted for 10–15% of overall maternal mortality in the first trimester in the past few decades.^{2,3} With an improvement of diagnostic tools e.g. high quality transvaginal ultrasonography, serum β -hCG determination,

and laparoscopic procedure; ectopic pregnancy can be detected at its earlier phase leading to lower morbidity and mortality rates.¹

Aside from an early diagnosis of ectopic pregnancy, there has been an improvement in surgical approach and technique in the last 20 years. In the past, the only approach for ectopic pregnancy treatment was laparotomy when either salpingectomy or salpingostomy would be performed.⁵ Nowadays, laparoscopic surgery becomes a recommended standard treatment for ectopic pregnancy because there are several advantages over laparotomy e.g. small abdominal incision, rapid recovery with shorter hospital stay, and etc. However, laparoscopic approach is probably suitable for the unruptured cases while laparotomy is still considered a better option in patients with hemodynamics instability or with severe pelvic adhesion.⁶

Our study aimed to compare the treatment outcomes of laparoscopic surgery and laparotomy for ectopic pregnancy in our hospital in terms of operative procedure, operative time, length of hospital stay, and postoperative requirement of analgesics.

Methods

A retrospective cohort study was performed to compare the outcomes of treatment of ectopic pregnancy between two groups of patients who had laparoscopic surgery vs laparotomy. The study protocol was approved by the Ethics Committee for Researches Involving Human Subjects, the Bangkok Metropolitan Administration. We reviewed medical records of patients who had surgical treatment for ectopic pregnancy at Faculty of Medicine Vajira hospital from January 1st, 2005 to December 31st, 2009. Patients who had the procedure converted to laparotomy (after the presence of ectopic pregnancy was confirmed) were excluded from the study. Cases were the patients who had laparoscopic surgical treatment while controls were those who underwent lap-

arotomy on the same or nearest date of case in a ratio of 1:1. Sample size was calculated using data from the study of Brumsted et al⁶ which compared postoperative analgesic usage between laparoscopy and laparotomy for treatment of ectopic pregnancy. The authors demonstrated less postoperative analgesic requirement in laparoscopy group compared to laparotomy group. Sample size calculation was done using 5% α error and 10% β error, when 42 patients were to be recruited in each group. Adding 15 percent for incomplete medical record, at least 49 patients in each group were required.

Demographic and operative data collected from inpatient medical records were: age, parity, gestational age, history of previous ectopic pregnancy, preoperative β -hCG level, size of ectopic mass at preoperative and intraoperative period, site of ectopic pregnancy, evidence of ruptured ectopic pregnancy at preoperative and intraoperative period, type of procedure performed, presence of pelvic adhesion, time of surgery, level of surgeon, operative time, length of hospital stay, postoperative pain score, dose of postoperative analgesics requirement, volume of hemoperitoneum and operative blood loss. Hemoperitoneum was defined as a presence of pre-existing blood in abdominal cavity. Preoperative diagnosis of hemoperitoneum was made from ultrasonographic finding. Its presence and volume was also estimated by the surgeon during the operation. Operative blood loss was defined as blood loss during the operative procedures.

As a standard practice for ectopic pregnancy in our hospital, all patients suspected to have ectopic pregnancy from physical and pelvic examination were to have immediate pelvic ultrasonography. The adnexae as well as other pelvic viscera were examined. Any identified mass/lesion was measured. Presence of abnormal free peritoneal fluid suspicious for hemoperitoneum was recorded as an evidence of ruptured ectopic pregnancy. The patients subjected to laparoscopic procedure should have had stable hemodynamic status during both preoperative and intraoperative period (after an initiation of

anesthesia and before the surgical procedure) regardless of the status of the ectopic mass (ruptured vs intact). Hemodynamically stable was defined when a patient had stable vital signs or without evidence of hypovolemic shock. Laparoscopic surgery or laparotomy was performed by an experienced faculty member or the resident under supervision. The ectopic mass (specific site, size, and intact status) and volume of hemoperitoneum (if present) were assessed upon entering into the abdomen.

In our hospital, laparotomy was performed through a pfannenstiell incision unless there was a midline scar from previous operation. Laparoscopy was performed through a subumbilical incision after achieving a pneumoperitoneum with carbon dioxide. An 11-mm operating laparoscope was inserted via subumbilical incision and two to three 5-mm suprapubic auxiliary ports were inserted. General anesthesia was used in both groups. With the same principle for both approaches, the surgeon would perform salpingostomy if clinical setting warranted and the condition was appropriate for a conservative approach. Salpingectomy would be conducted when salpingostomy was not possible or the ectopic mass was ruptured with massive bleeding. In case of impending tubal abortion, the surgeon would perform fimbrial expression of conceptive product. Cornual pregnancy would be resected and sutured. Gross examination of other pelvic pathology was also performed and the lesions would be managed as appropriate.

Postoperative pain was assessed by visual analogue scales (VAS) by the nurse in charge during the first 24 hours postoperation.⁷ Intravenous pethidine 50 mg was routinely prescribed as an analgesic drug for the patients who had laparotomy, with a repeated dose every 4–6 hours as needed. The patients who had laparoscopic surgery were only given intravenous pethidine 25 mg when the VAS scores were between 4–7 or 50 mg when the scores were higher than 7.

Data were analysed using SPSS version 11.5. Quantitative data of age, gestational age, size of ectopic

pregnancy, preoperative β -hCG level, volume of hemoperitoneum, operative blood loss, operative time, length of hospital stay, postoperative pain score and use of analgesic (usually meperidine) were reported as mean $\pm$ SD or median with range. Data between the two groups were compared by Mann-Whitney U test or student t-test as appropriate. Qualitative data of type of surgical procedures, location of the ectopic pregnancy, presence of pelvic adhesion, level of surgeon and time of surgery were reported as frequency and compared between the two groups using chi-square or Fisher's exact test as appropriate. P-value < 0.05 was considered statistically significant.

Results

Ninety eight patients who presented with ectopic pregnancy and had surgery at Vajira Hospital were grouped into cases (49 patients who had laparoscopic surgery) and controls (49 patients who had laparotomy). Demographic data of the patients are shown in Table 1. There were no differences in mean age, parity and history of previous ectopic pregnancy between the two groups. Gestational age of the patients in laparoscopy group was significantly less than laparotomy group (6.8 vs 7.6 weeks, p-value = 0.032). Almost all laparoscopic surgical procedures were performed by staffs and all were during office hours whereas most laparotomies were done by residents and in non-office hours (Table 2).

No statistically significant differences in preoperative β -hCG levels between the two groups were observed. Majority of ectopic pregnancy was found at the fallopian tube in both groups. The remaining site of ectopic pregnancy was at cornue which was found in laparoscopic group only. The size of ectopic mass in laparoscopic group either measured by preoperative ultrasonography (2.6 ± 0.4 cm vs 3.7 ± 0.6 cm, p-value < 0.001) or estimated intraoperation (2.9 ± 0.4 cm vs 3.3 ± 0.5 cm, p-value < 0.001) was significantly smaller

Table 1 Demographic data of the patients with ectopic pregnancy according to the operative approach (n=98)

Demographic data	Laparoscopy (n=49)		Laparotomy (n=49)		p-value
	number	percent	number	percent	
Age (years) ^a	28.2 ± 6.2		26.5 ± 6.1		0.174
Parity ^b					0.642
0	27	55.1	24	50.0	
1	12	24.5	11	22.4	
≥ 2	10	20.4	14	28.6	
Previous ectopic pregnancy ^c	4	8.2	1	2.0	0.362
Gestational age at diagnosis (weeks) ^d	6.8 (5.2–7.4)		7.6 (5.8–8.1)		0.032

^a data were presented as mean ± SD and compared by unpaired t-test

^b data were compared by chi-square test

^c data were compared by Fisher's exact test

^d data were presented as median (minimum–maximum) and compared by Mann–Whitney U test

than that in laparotomy group. Although preoperative diagnosis of ruptured ectopic pregnancy was more frequently in laparotomy than the laparoscopic group (8.2% compared to 2.0%), the difference was not significant (p-value = 0.361). Nevertheless, the numbers of ectopic pregnancy which were actually ruptured (detected during the operation) were significantly higher in the laparotomy than the laparoscopic group: 34.7% vs 10.2% (p-value = 0.004).

Pelvic adhesion was found more in laparoscopic than laparotomy groups (51.0% vs 38.8%), however, they were not significantly different (p-value = 0.223). The amount of hemoperitoneum measured intraoperatively in laparoscopic group was significantly lower than in laparotomy group (40 ml vs 200 ml, p-value < 0.001). While intraoperative blood loss in laparoscopic group was significantly higher than in laparotomy group, 112.2 ± 18.1 ml vs 50.4 ± 15.2 ml (p-value < 0.001).

The operative data and outcomes are summarized in Table 2. There were statistically significant differences in the types of operative procedures between the

two groups (p-value < 0.001). More than half (55.1%) of laparoscopic group had salpingostomy while only 28.6% had salpingectomy. On the contrary, 63.3% of laparotomy group had salpingectomy while only 24.5% had salpingostomy. Fimbrial expression of trophoblast was performed in 10.2% in laparoscopy group and 12.2% in laparotomy group. Oophorectomy was performed in 2 cases in laparoscopic group due to ovarian pathology, 1 for dermoid cyst and the other for endometriotic cyst. We also studied the association between the type of procedures and level of surgeon. Higher numbers of the residents performed radical tubal procedure (salpingectomy) than the attending staff: 67.4% vs 32.6% respectively (p-value = 0.036).

Focusing on the operative time, laparoscopic surgery consumed significantly longer time than laparotomy, 115.3 ± 20.2 minutes vs 67.1 ± 14.4 minutes (p-value < 0.001). When we studied the operative time according to the type of surgical procedure, no significant difference between the type of procedures and duration of surgery was observed.

Table 2 Operative data in the laparoscopy & laparotomy groups (n=98)

Operative data	Laparoscopy (n=49)		Laparotomy (n=49)		p-value
	number	percent	number	percent	
Preoperative					
β-hCG level (IU/ml) ^a	1361 (320–3152)		871 (418–3910)		0.431
Size of ectopic mass from ultrasonography (cm) ^b	2.6 ± 0.4		3.7 ± 0.6		< 0.001
Evidence of ruptured mass by ultrasonography ^c	1	2.0	4	8.2	0.361
Intraoperative					
Size of ectopic mass (cm) ^b	2.9 ± 0.4		3.3 ± 0.5		< 0.001
Site of ectopic mass ^c					0.242
tubal	46	93.9	49	100	
cornue	3	6.1	–	–	
Presence of pelvic adhesion ^d	25	51.0	19	38.8	0.223
Evidence of ruptured ectopic mass ^d	5	10.2	17	34.7	0.004
Hemoperitoneum (ml) ^a	40 (0–1000)		200 (0–1200)		< 0.001
Intraoperative blood loss (ml) ^b	112.2 ± 18.1		50.4 ± 15.2		< 0.001
Type of operative procedures for ectopic pregnancy ^d					< 0.001
salpingostomy	27	55.1	12	24.5	
salpingectomy	14	28.6	31	63.3	
others procedures	8	16.3	6	12.2	
fimbrial trophoblast expression with adhesiolysis	5	10.2	6	12.2	
cornual resection	3	6.1	–	–	
Period of surgery ^d					< 0.001
office hours	49	100	14	28.6	
non-office hours	0	0	35	71.4	
Surgeons ^d					
staff	47	95.9	2	4.1	< 0.001
resident	2	4.1	47	95.9	
Operative time (minutes) ^b	115.3 ± 20.2		67.1 ± 14.4		< 0.001
Length of hospital stay (days) ^b	2.1 ± 0.3		3.5 ± 0.4		< 0.001
Postoperative pain score (VAS) ^b	2.4 ± 1.2		6.0 ± 1.0		< 0.001
Postoperative analgesic requirement (doses) ^b	1.2 ± 1.0		4.0 ± 1.0		< 0.001

^a data were presented as median (minimum–maximum) and compared by Mann–Whitney U test^b data were presented as mean ± SD and compared by unpaired t test^c data were compared by Fisher's exact test^d data were compared by chi-square test

Postoperation, the patients who underwent laparoscopic surgery had significant lower postoperative pain score (2.4 ± 1.2 vs 6.0 ± 1.0 , p -value < 0.001), lower meperidine need (1.2 ± 1.0 doses vs 4.0 ± 1.0 doses, p -value < 0.001) and shorter hospital stay (2.1 ± 0.3 days vs 3.5 ± 0.4 days, p -value < 0.001) compared to those in laparotomy group (Table 2).

Discussion

Ectopic pregnancy is an emergency medical condition that requires a precise diagnosis and a proper management. An appropriate and timely treatment of ectopic pregnancy plays an important role in reducing morbidity and mortality caused mainly by massive intraabdominal hemorrhage. Surgery which remains the mainstay of treatment can be approached either by laparotomy or laparoscopy.^{1,6,8}

Since this study included only the patients who had successful laparoscopic operation, some features found in this particular group of our patients may be used as selective criteria for laparoscopic surgery. These features were: less gestational age (less than 7 weeks), smaller ectopic mass (less than 3 cm), intact ectopic mass, and limited amount of hemoperitoneum. Some findings from our study were similar to those from the study of Yuen and Rogers⁹ who conducted a retrospective study comparing treatment outcomes of laparoscopic surgery and laparotomy in 105 patients who had ectopic pregnancy. The authors demonstrated that laparoscopic group had lower incidence of ruptured ectopic mass during operation and lower hemoperitoneum compared to laparotomy group.⁹ Actually, these more favorable factors of unruptured ectopic mass and lesser amount of hemoperitoneum may be the cause or reason (rather than the effect or result) why the surgeon made his decision to perform laparoscopy rather than laparotomy.

It was demonstrated that the patients who had stable vital sign, regardless of the integrity of the ec-

topic mass or hemoperitoneum, tended to have laparoscopic surgery.¹⁰ This was also observed in our study that one of our patients who had been hemodynamically stable could still have a successfully laparoscopic surgery despite massive hemoperitoneum found intraoperation. Therefore, we rather proposed that laparoscopic surgery is not only suitable for unruptured ectopic pregnancy but also safe in case of a ruptured mass but with stable hemodynamics.

Concerning the type of operative procedures, more women in the laparoscopic group had conservative surgery or salpingostomy (55%) and less had radical or salpingectomy (29%). These findings were reversed in the women in laparotomy group with the corresponding figures of 25% and 63%. Few reasons were to be noted why successful salpingostomy was observed more in the laparoscopy group. These were lower incidence of ruptured ectopic mass (10% vs 35%), less amount of hemoperitoneum (40 ml vs 200 ml), and the higher expertise of the surgeons (96% vs 4%) in the laparoscopic surgery group than that in the laparotomy group. From any reasons, laparoscopic salpingostomy certainly yielded a major benefit in terms of tubal preservation compared to laparotomy. This benefit was to be emphasized when the majority of patients with this condition were young as found in our study and had no or only one child that fertility function was important.

Our study found a significant longer operative time in laparoscopic group than laparotomy (115 ± 20 mins vs 67 ± 14 mins, p -value < 0.001). This was different from previous study of Brumsted et al⁶ who reported a shorter operative time in laparoscopic group. Expertise of surgeon should not be the reason for a long operative time because almost all of the laparoscopic procedures in both studies were performed by the attending staff. It was neither due to the type of surgical procedure because we found no significant difference of operative time in the patients having salpingostomy or salpingectomy. We observed that other time-consuming procedures of fimbrial expression of trophoblast with

adhesiolysis, cornual resection or oophorectomy were performed more frequently in the laparoscopic group. These operative procedures may contribute to the longer operative time and tendency of higher operative blood loss in the laparoscopic group.

A significant lower pain score, less requirement for postoperative analgesics, and reduction of hospital stay in the laparoscopic group compared to laparotomy group demonstrated in our study were consistent to the findings from the other studies.^{5,6} Brumsted et al⁶ demonstrated that patients treated laparoscopically had significantly lower postoperative analgesic requirements (0.8 ± 2.3 doses vs 4.6 ± 2.9 doses, p -value < 0.001) and shorter hospital stays compared to those who had laparotomy (1.34 ± 0.8 days vs 3.92 ± 1.1 days, p -value < 0.001). Vermesh et al⁵ also reported significantly shorter hospital stay after laparoscopic salpingostomy than after laparotomy (1.4 ± 0.1 days vs 3.3 ± 0.2 days, p -value < 0.001).

In conclusion, laparoscopic treatment of ectopic pregnancy yielded superior benefits over laparotomy in terms of tubal preservation (which would increase the chance of future fertility), lower postoperative pain score with lower analgesics, and shorter hospital stay. However, some of these findings were confounded by the selective bias that the patients with better conditions were preferentially subjected to laparoscopic surgery. More data from a prospective well controlled study are needed to confirm these favorable results of the laparoscopic treatment approach for ectopic pregnancy.

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