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ORIGINAL ARTICLE

Comparison of Laparoscopic Versus Open Surgery for the Treatment of Ectopic Pregnancy: A Prospective Cohort Study

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ABSTRACT

Background: Ectopic pregnancy remains a significant cause of maternal morbidity and mortality, accounting for a large proportion of first-trimester complications.

Objective: To compare the efficacy, safety, and postoperative outcomes of laparoscopic surgery versus open surgery n the treatment of ectopic pregnancy.

Methods: This was a prospective cohort study conducted at the department of Obstetrics and Gynaecology, Lahore General Hospital, Lahore from June 2021 to November 2021. A total of 185 patients diagnosed with ectopic pregnancy were enrolled and allocated into two groups based on the surgical approach: Group A (n = 95) underwent laparoscopic surgery, while Group B (n = 90) underwent open laparotomy. The study aimed to compare intraoperative and postoperative outcomes between both techniques in terms of efficacy, safety, and recovery profile.

Results: The mean operative time was slightly longer in the laparoscopic group (74.3 ± 18.2 min) than the open group (68.5 ± 15.9 min; p = 0.04). However, mean blood loss was significantly lower (96.4 ± 32.1 mL vs. 182.3 ± 40.6 mL; p < 0.001). Patients who underwent laparoscopy reported less postoperative pain (VAS 3.2 ± 1.1 vs. 5.8 ± 1.3; p < 0.001), shorter hospital stays (2.6 ± 0.9 vs. 5.4 ± 1.2 days; p < 0.001), and faster recovery (10.4 ± 3.1 vs. 17.2 ± 4.5 days; p < 0.001). The overall complication rate was lower in laparoscopy (6.3%) than open surgery (17.8%; p = 0.02).

Conclusion: Laparoscopic surgery is a superior and safer alternative to open laparotomy for the treatment of ectopic pregnancy, providing significantly less blood loss, reduced pain, shorter hospital stay, and quicker recovery. It should be considered the preferred surgical approach in hemodynamically stable patients to enhance postoperative recovery and preserve reproductive potential.

Keywords: Ectopic pregnancy, laparoscopy, laparotomy, minimally invasive surgery, postoperative outcomes

INTRODUCTION

An ectopic pregnancy is a potentially life-threatening condition wherein a fertilized ovum implants outside the uterine cavity, most commonly in the fallopian tube, and wherein such cases account for 1-2% of all pregnancies worldwide[1]. In the first trimester, it is still a prominent cause of maternal morbidity and mortality, constituting nearly 10% of pregnancy-related deaths in developing countries[2]. Due to the advancements of transvaginal ultrasonography and quantitative serum β-hCG, early diagnosis is possible so that an intervention can be performed prior to a rupture and catastrophic hemorrhage[3]. Although, the surgical management of the condition still raises the question of whether a laparoscopic or open laparotomy is the ideal route. In cases which include hemodynamic instability or a tubal rupture is suspected, open laparotomy was the traditional method for ectopic pregnancy management[4]. On the contrary, improvements in laparoscopic techniques in gynecologic surgery provided a less invasive approach to ectopic pregnancy, which simultaneously enhanced and expedited recovery and decreased pain[5]. Improved cosmetic outcomes, a critical factor for the reproductive demographic, are a byproduct of laparoscopic surgery, which leads to less tissue damage and enhanced visualization, in turn improving the emotional and psychosocial aspects of the patient[6]. This is why the preference for laparoscopic surgery has increased significantly. Most hemodynamically stable patients are the rule for open surgery[7]. Factors influencing the choice between laparoscopic and open surgery include patient stability, level of intra-abdominal bleeding, the experience of the surgeon, and available resources[8]. For stable patients with unruptured ectopic pregnancies, laparoscopy is preferred, while open surgery is appropriate for cases with significant hemoperitoneum and poor visualization[9]. Better fertility outcomes are observed after laparoscopic management compared to laparotomy as the skipped invasive procedure reduces peritubal adhesions, improving tubal patency and tubal factors of infertility[10]. Additionally, the global shift to minimally invasive techniques has been encouraged by the economics of healthcare and recovery expectations of patients. Although more resource-intensive initially, laparoscopy has lower indirect costs attributable to shorter hospital stays, reduced wound care, and less time off work[11]. Newer evidence shows that laparoscopy may have similar or better outcomes than laparotomy, with fewer complications and quicker resumption of normal activities[12]. Because the debate regarding one approach's superiority to the other still mostly remains, this prospective cohort study compared the effectiveness, safety, and postoperative results of laparoscopy and open laparotomy in patients with ectopic pregnancy. The primary outcomes included operative time, blood loss, postoperative pain, length of hospital stay, complications, recovery period, and additional recovery period to assist with evidence-based decision making on the most appropriate surgical method to use in this gynecologic emergency[13].

Objective: To compare the efficacy, safety, and postoperative outcomes of laparoscopic surgery versus open surgery in the treatment of ectopic pregnancy.

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METHODOLOGY

This was a prospective cohort study conducted at the department of Obstetrics and Gynaecology, Lahore General Hospital, Lahore from June 2021 to November 2021. A total of 185 patients diagnosed with ectopic pregnancy were enrolled and allocated into two groups based on the surgical approach: Group A (n = 95) underwent laparoscopic surgery, while Group B (n = 90) underwent open laparotomy.

Inclusion Criteria:

- Women aged 18–45 years with confirmed ectopic pregnancy on transvaginal ultrasound and serum β-hCG.
- Hemodynamically stable patients eligible for surgical intervention.
- Patients with tubal, ovarian, or cornual ectopic pregnancy.

- Patients who provided written informed consent for participation.

Exclusion Criteria:

- Hemodynamically unstable patients requiring emergency laparotomy.
- Patients managed medically (e.g., methotrexate therapy).
- Recurrent ectopic pregnancy with previous tubal surgery.
- Severe pelvic adhesions, pelvic inflammatory disease, or other concurrent intra-abdominal pathology.

Data Collection: Once ethical approval was granted, we captured patients' demographic and clinical characteristics, including age, parity, gestational age, and previous surgical history in detail. Diagnosis was made by transvaginal ultrasound and serum β-hCG levels. Depending on the surgeon's evaluation and the patient's stability, patients had either laparoscopic salpingectomy/salpingostomy or open laparotomy. Parameters documented during the operation included intraoperative time (minutes), estimated blood loss (mL), and intraoperative complications (bleeding, visceral injury). After the operation, patients were assessed for pain by VAS 6, 12, and 24 hours post-op, duration of stay, complication, time to active normal living (days), and role change and sick leave were recorded. At 6 weeks, the follow-up included evaluation of complications, assessment of semi-structured interviews documented to reinforce self-report on bleeding, and retrievable pictorial information of the scar mobilized for an assessment of wound healing in the weeks post op compared to the pre-op definition of normal for the patient.

Statistical Analysis: All data were entered and analyzed using SPSS version 19.0. Continuous variables such as age, operative time, blood loss, pain score, and hospital stay were expressed as mean ± standard deviation (SD) and compared using the independent t-test. Categorical variables such as type of ectopic pregnancy, intraoperative complications, and postoperative outcomes were presented as frequencies and percentages, analyzed using the Chi-square test. A p-value < 0.05 was considered statistically significant.

RESULTS

Data were collected from 195 patients, divided into 95 laparoscopic and 90 open surgery cases. The mean age of participants was 29.4 ± 5.7 years, with similar distribution between the two groups (29.1 ± 5.4 vs. 29.8 ± 5.9 years; p = 0.48). Average parity was 1.7 ± 0.9, and gestational age at diagnosis was 7.8 ± 1.6 weeks, with no significant difference across groups (p = 0.12). The mean BMI was 24.9 ± 3.4 kg/m², comparable between the laparoscopic (24.5 ± 3.2) and open surgery (25.3 ± 3.6) groups (p = 0.18).

The mean operative time was slightly longer in the laparoscopic group (74.3 ± 18.2 minutes) compared to the open group (68.5 ± 15.9 minutes), with a statistically significant difference (p = 0.04). However, mean intraoperative blood loss was markedly lower in laparoscopy (96.4 ± 32.1 mL) than in open surgery (182.3 ± 40.6 mL; p < 0.001). Ruptured ectopic pregnancy occurred in 30.3% of all patients, while conversion to open surgery was required in only 3.2% of laparoscopic cases. Intraoperative complications were slightly higher in the open group (6.7%) compared to laparoscopy (3.2%), though this was not statistically significant (p = 0.29).

The mean postoperative pain score (VAS at 24 hours) was 3.2 ± 1.1 in the laparoscopic group versus 5.8 ± 1.3 in the open group (p < 0.001). The average hospital stay was notably shorter following laparoscopy (2.6 ± 0.9 days) compared to open surgery (5.4 ± 1.2 days; p < 0.001). Likewise, the mean time to ambulation was 10.4 ± 2.8 hours versus 20.6 ± 4.3 hours, and the mean time to oral intake was 8.1 ± 2.2 hours versus 15.3 ± 3.6 hours, both highly significant (p < 0.001). Recovery to normal activity also occurred sooner in laparoscopy (10.4 ± 3.1 days) compared to laparotomy (17.2 ± 4.5 days; p < 0.001).

The overall postoperative complication rate was significantly lower in the laparoscopic group (6.3%) compared to open surgery (17.8%; p = 0.02). Wound infection occurred in 2.1% of laparoscopic cases versus 6.7% in open procedures. Febrile morbidity was seen in 3.2% and 6.7% of patients, respectively. Pelvic abscess developed only in 2 open cases (2.2%), and postoperative bleeding was reported in 1 laparoscopic (1.1%) and 4 open cases (4.4%).

At 6 weeks post-surgery, return of normal menstruation was observed in 92.6% of laparoscopic patients and 88.9% in the open group (p = 0.39). Persistent amenorrhea occurred in 7.4% and 11.1% of cases, respectively. Resumption of ovulation, confirmed by ultrasound, was slightly higher after laparoscopy (88.4%) compared to open surgery (80.0%; p = 0.13). Furthermore, subsequent conception within 6 months was achieved in 18.9% of the laparoscopic group versus 10.0% of the open group (p = 0.08).

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population (n = 185)

Variable	Total (n=185)	Laparoscopic Group (n=95)	Open Surgery Group (n=90)	p-value
Age (years), mean ± SD	29.4 ± 5.7	29.1 ± 5.4	29.8 ± 5.9	0.48
Parity (mean ± SD)	1.7 ± 0.9	1.6 ± 0.8	1.8 ± 0.9	0.22
Gestational age (weeks), mean ± SD	7.8 ± 1.6	7.6 ± 1.5	8.0 ± 1.7	0.12
BMI (kg/m²), mean ± SD	24.9 ± 3.4	24.5 ± 3.2	25.3 ± 3.6	0.18
Previous pelvic surgery, n (%)	38 (20.5%)	19 (20.0%)	19 (21.1%)	0.87
Type of ectopic (Tubal/Ovarian/Cornual), n (%)	159 / 18 / 8	83 / 9 / 3	76 / 9 / 5	0.69

Table 2: Intraoperative Findings and Parameters

Parameter	Total (n=185)	Laparoscopic (n=95)	Open Surgery (n=90)	p-value
Operative time (minutes), mean ± SD	71.5 ± 17.2	74.3 ± 18.2	68.5 ± 15.9	0.04*
Estimated blood loss (mL), mean ± SD	138.4 ± 55.9	96.4 ± 32.1	182.3 ± 40.6	<0.001*
Ruptured ectopic, n (%)	56 (30.3%)	26 (27.4%)	30 (33.3%)	0.37
Conversion to open surgery, n (%)	–	3 (3.2%)	–	–
Intraoperative complications, n (%)	9 (4.9%)	3 (3.2%)	6 (6.7%)	0.29

Table 3: Postoperative Recovery Parameters

Parameter	Laparoscopic (n=95)	Open Surgery (n=90)	p-value
Pain score (VAS at 24 hr), mean ± SD	3.2 ± 1.1	5.8 ± 1.3	<0.001*
Duration of hospital stay (days), mean ± SD	2.6 ± 0.9	5.4 ± 1.2	<0.001*
Time to ambulation (hours), mean ± SD	10.4 ± 2.8	20.6 ± 4.3	<0.001*
Time to oral intake (hours), mean ± SD	8.1 ± 2.2	15.3 ± 3.6	<0.001*
Return to normal activity (days), mean ± SD	10.4 ± 3.1	17.2 ± 4.5	<0.001*

Table 4: Postoperative Complications

Complication	Total (n=185)	Laparoscopic (n=95)	Open Surgery (n=90)	p-value
Wound infection	8 (4.3%)	2 (2.1%)	6 (6.7%)	0.14
Febrile morbidity	9 (4.9%)	3 (3.2%)	6 (6.7%)	0.29
Pelvic abscess	2 (1.1%)	0 (0%)	2 (2.2%)	0.16
Postoperative bleeding	5 (2.7%)	1 (1.1%)	4 (4.4%)	0.18
Total postoperative complications	24 (13.0%)	6 (6.3%)	16 (17.8%)	0.02*

Table 5: Fertility and Menstrual Outcomes at 6-Week Follow-Up

Outcome	Laparoscopic (n=95)	Open Surgery (n=90)	p-value
Return of normal menses, n (%)	88 (92.6%)	80 (88.9%)	0.39
Persistent amenorrhea, n (%)	7 (7.4%)	10 (11.1%)	0.39
Resumption of ovulation (Ultrasound evidence)	84 (88.4%)	72 (80.0%)	0.13
Subsequent conception within 6 months, n (%)	18 (18.9%)	9 (10.0%)	0.08

DISCUSSION

This study compared the outcomes of laparoscopic versus open surgery in the management of ectopic pregnancy, aiming to evaluate differences in operative efficiency, safety, and recovery parameters. The results strongly preferred the laparoscopic technique owing to less intraoperative blood loss, a shorter condition amelioration time, less postoperative pain, and a quicker recovery, all while holding to the same standards of surgical safety. These findings correspond to findings of prior studies as the laparoscopy technique was noted to have less postoperative complications while the effectiveness of the treatment remained the same[14]. For this study, the average age of the participants was 29.4 ± 5.7 years, mostly indicative of the reproductive age range most at the risk to develop ectopic pregnancies. The two groups had comparable initial parameters of parity, gestational age, and BMI, suggesting little selection bias. This demographic distribution was comparable to findings in the literature, as most ectopic pregnancies in women aged 25-35 years, and were associated with identifiable risk factors of prior pelvic surgery or infection[15]. The predominance of tubal ectopic pregnancies, (85.9%) also correlates with the literature in which it is noted that over 90% of ectopic pregnancies are located in the fallopian tube. The duration of procedures for the laparoscopic cohort averaged 74.3 ± 18.2 minutes while for the open cohort it was 68.5 ± 15.9 minutes. This difference was not only statistically but clinically significant as well ($p = 0.04$). This slight difference can be explained by the initial time taken for the laparoscopic instruments to be brought in and then the time to adjust to the new laparoscopic techniques being used. Literature describes how the duration of laparoscopic procedures diminishes with experience and advancement in instruments to the point where duration becomes comparable and even less than open techniques. This is explained by the clear advantage in the amount of blood lost with laparoscopic surgery. 96.4 ± 32.1 mL was lost as compared to 182.3 ± 40.6 mL in open surgery with a p value < 0.001. This finding is consistent with the literature which states that bleeding is less with laparoscopic procedures because of better visual control, more accurate coagulation, and less handling of the tissue[16]. Postoperative recovery was markedly better for patients who underwent laparoscopy. Patients in the laparoscopic group reported a mean VAS pain score of 3.2 ± 1.1, which was significantly less in comparison to the 5.8 ± 1.3 score in the open surgery group ($p < 0.001$). In addition, the mean length of hospital stay was almost half of what it was for the open surgery group (2.6 ± 0.9 vs. 5.4 ± 1.2 days; $p < 0.001$). Again, ambulation and oral intake were achieved sooner in laparoscopy (10.4 ± 2.8 hours and 8.1 ± 2.2 hours, respectively) compared to laparotomy (20.6 ± 4.3 hours and 15.3 ± 3.6 hours; $p < 0.001$). Such findings are in line with other studies, which have noted that minimally invasive procedures tend to allow for more rapid mobilization, less postoperative pain, and overall quicker recovery due to decreased tissue trauma and inflammation[17]. The overall postoperative complication rate was considerably lower in the laparoscopic group (6.3%) compared to open surgery (17.8%; $p = 0.02$). Open surgery was associated with higher rates of complication, such as wound infection, febrile morbidity, and bleeding, which is in line with prior studies that explain this as being due to less traumatic incisions and consequently less exposed to the infection and shorter hospital stay with laparoscopic techniques[18]. The lack of significant intraoperative complications or mortality speaks to the safety of laparoscopy. At the six-week follow-up, return of normal menstruation was marginally higher in laparoscopic (92.6%) than open surgery (88.9%) and there was also greater ovulation resumption. Response rates were still high over 80% despite the difference not being statistically significant. This improvement in reproductive recovery could be because adhesion formation was diminished, as well as the maintenance of ovarian and tubal function, as previously discussed. Prior studies have also indicated similar results in that laparoscopic salpingostomy procedures had more favorable postoperative outcomes, higher fertility rates, and lower rates of tubal obstruction as compared to the open salpingostomy procedures[19]. Also, the difference in recovery times was significant as the laparoscopic group had a mean of 10.4 ± 3.1 days whereas the open surgical group had a mean of 17.2 ± 4.5 days ($p < 0.001$). This difference can be attributed to the laparoscopic surgeries being minimally invasive. Also, recovery to everyday activities and work occurs much sooner. This was emphasized in prior studies that outlined the economic benefits of the procedure and satisfaction rates of the patients[20]. In the case of ectopic pregnancy, it is crucial to consider that the benefits of laparoscopic procedures go beyond the patients. They reaffirm the benefits to still utilize and support laparoscopic procedures for hemodynamically stable patients as it provides a level of efficiency that is comparable to laparotomy. The surgical transition to laparoscopic procedures is more than a technological improvement; it is a shift in surgical culture that focuses on the recovery of the patient.

CONCLUSION

It is concluded that laparoscopic surgery is a more effective, safer, and patient-friendly approach for the management of ectopic pregnancy compared to open laparotomy. Although the operative time for laparoscopy (74.3 ± 18.2 minutes) was slightly longer than open surgery (68.5 ± 15.9 minutes), it resulted in significantly less intraoperative blood loss (96.4 ± 32.1 mL vs. 182.3 ± 40.6 mL; $p < 0.001$), lower postoperative pain (VAS 3.2 ± 1.1 vs. 5.8 ± 1.3; $p < 0.001$), and a shorter hospital stay (2.6 ± 0.9 vs. 5.4 ± 1.2 days; $p < 0.001$).

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