

Laparoscopic Management of Ectopic Pregnancy

Prof. Dr. R. K. Mishra

■ INTRODUCTION

An ectopic pregnancy is a pregnancy outside of the uterine cavity. The majority of ectopic pregnancies occurs in the fallopian tube, but other possible sites include cervical, interstitial, hysterotomy scar, intramural, ovarian, or abdominal. In addition, in rare cases, a multiple gestation may be heterotopic.

Ectopic pregnancy is a potentially life-threatening condition. While surgical approaches are the gold-standard treatment, advances in early diagnosis in the 1980s facilitated the introduction of medical therapy with methotrexate. With the routine use of early ultrasound, diagnosis of ectopic pregnancy can be established early and medical treatment can be administered in most cases. The overall success rate of medical treatment in properly selected women is nearly 90%. In select cases of early ectopic pregnancy or pregnancy of unknown location, expectant management is an option.

■ ECTOPIC PREGNANCY

The risk of ectopic pregnancy is higher in white women. It increases three to four times in women between the age of 35 and 44 years compared to those from 15 to 24 years. About 64% of ectopic pregnancies occur in the ampulla where fertilization occurs. The recent increase in incidence of ectopic pregnancy has been attributed to a greater incidence of sexually transmitted disease (STD), delayed childbearing, previous sexual organ surgical interference, and successful clinical detection. Any condition that prevents or retards migration of fertilized ovum to the uterine cavity could predispose a woman to an ectopic gestation (**Fig. 1**).

Ectopic pregnancy usually occurs in the fallopian tube in 99% of cases (**Fig. 1**). Its distribution is as follows:

- The ampulla (64%)
- The isthmus (25%)
- The infundibulum (9%)
- The intramural junction (2%)
- Ovarian (0.5%)
- Cervical (0.4%)
- Abdominal (0.1%)
- Intraligamental (0.05%)

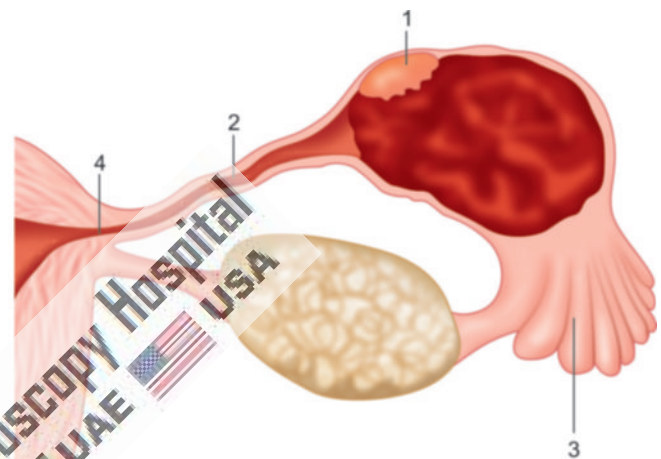


Fig. 1: Tubal pregnancy: (1) the ampulla; (2) the isthmus (3) the infundibulum; and (4) the intramural junctions.

Major contributing factors and associated relative risks for ectopic pregnancy are as follows:

- Current use of intrauterine device (11.5%)
- Use of clomiphene citrate (10%)
- Prior tubal surgery (5.6%)
- Pelvic inflammatory disease (4.0%)
- Infertility (2.9%)
- Induced abortion (2.5%)
- Adhesions (2.4%)
- Abdominal surgery (2.3%)
- T-shaped uterus (2%)
- Myoma (1.7%)
- Progestin only contraceptives (1.6%)

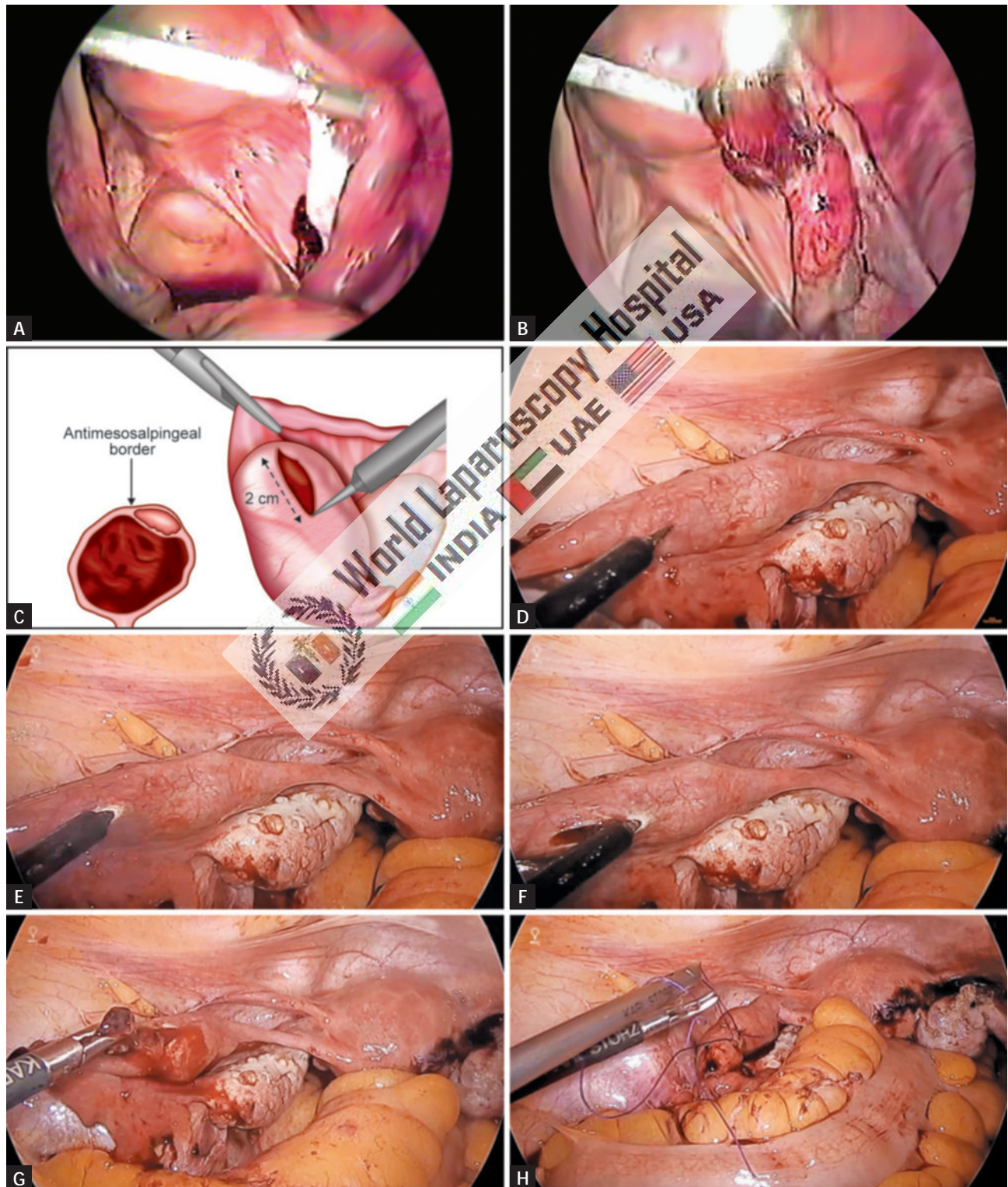
If laparoscopy is planned, the location, the size, and the nature of the tubal pregnancy should be ascertained preoperatively. If the bleeding has ceased or can be arrested adequately, ruptured tubal pregnancies can be treated successfully endoscopically. Once bleeding is controlled, the products of conception and blood clots are removed. If there is >1,500 cc hemoperitoneum, laparoscopic approach is contraindicated. Heparinized saline should be used in cases of large hematoma. Large ruptured ectopic may require extracorporeal knotting.

A 10-mm suction instrument is used to clean the abdominal cavity. Forced irrigation with normal saline

should dislodge the clot and trophoblastic tissue from the serosa of the peritoneal organs with minimal injury to these structures (**Figs. 2A to H**).

For unruptured tubal pregnancy, the involved fallopian tube is identified and mobilized to minimize bleeding, a 5–8 mL of diluted solution containing five unit vasopressin in 20 mL of saline is injected with a 20 G

spinal or a laparoscopic needle. It should be injected in the mesosalpinx just below the ectopic and over the antimesenteric surface of the tubal segment containing gestational product. The needle must not be inserted deep within a blood vessel because intravascular injection may precipitate acute arterial hypertension, bradycardia, and sometime, it may even be fatal (**Fig. 3**).



Figs. 2A to H: Salpingotomy for unruptured ectopic pregnancy.

After stabilizing the tube by grasper in one hand and microelectrode in other, a linear incision is made on the antimesenteric surface extending 1–2 cm over the thinnest portion of tube. The fine needle tip should be used in the cutting mode, and should barely touch the tissue surface. With electrosurgery, thermal damage may spread if large tips are used on large surface areas in contact with tissue. It is important to remain aware of the location of underlying or adjacent structures. If the gynecologists are not careful, there may be a chance of adjacent visceral injury. The pregnancy usually should protrude through the incision and slowly slips out of tube. It may be teased gently out using hydrodissection or laparoscopic atraumatic forceps. Sometimes forceful irrigation in the tubal opening can dislodge the gestation from implantation. As pregnancy is pulled out or extrudes from the tube, some of the products of conception can remain adhered to the implantation site by a ligamentous structure containing blood vessels. Using bipolar, this structure should be coagulated before removing the tissue. Depending upon the size of the product of

conception, ectopic mass is removed, usually through a 10 mm trocar sleeve.

Resection of the tubal segment containing the gestation is preferable to salpingostomy for an isthmic pregnancy or a ruptured tube or if hemostasis is difficult to obtain. Segmental tubal resection is performed by the help of bipolar forceps or harmonic scalpel. Automatic stapling or suturing devices can be used for bloodless tubal resection. If the mesosalpinx bleeds, it should be cauterized by using bipolar forceps, particular attention being given to the arcuate anastomosing branches of the ovarian and uterine arteries. Total salpingectomy is performed by progressively coagulating and cutting the mesosalpinx, beginning with the proximal portion to fimbrial end. It is separated from the uterus using bipolar coagulation and scissors (**Figs. 4A and B**). The isolated segment containing the tubal pregnancy is removed intact or in sectioned part, through the 10 mm trocar sleeve. The products of conception can be placed in a plastic bag and removed. Multifire stapling devices for salpingectomy require a 10 mm trocar. If the tissue is bulky and cannot be accommodated through cannula, an endobag can be used for retrieval of tissue.

Adhesions or other pathologic processes such as endometriosis can be treated simultaneously during the removal of ectopic pregnancy without significantly prolonging the operation. In 1 week, the beta-human chorionic gonadotropin (β -hCG) should return to baseline, i.e., undetectable or very low.

If the pregnancy is interstitial, it may be associated with traumatic rupture, hemorrhagic shock, and there is twofold increase in maternal mortality over other tubal pregnancies. Delayed diagnosis and increased vascularity of this make laparoscopic procedure difficult. Only 2–4% of ectopic are interstitial. The anatomy of ectopic accommodates the growing gestation, accounting for its late recognition. The traditional management is better in these cases, i.e., salpingectomy with or without cornual resection and in some difficult cases, hysterectomy may be necessary. Interstitial pregnancy can be suspected at the time of laparoscopy when large and asymmetrical uterus is seen.

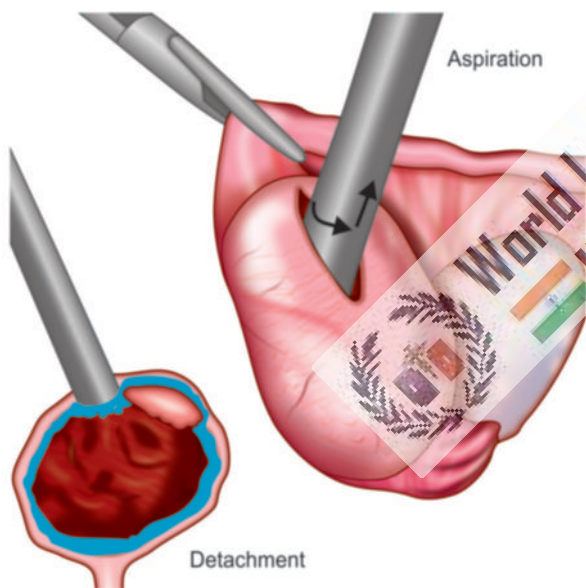
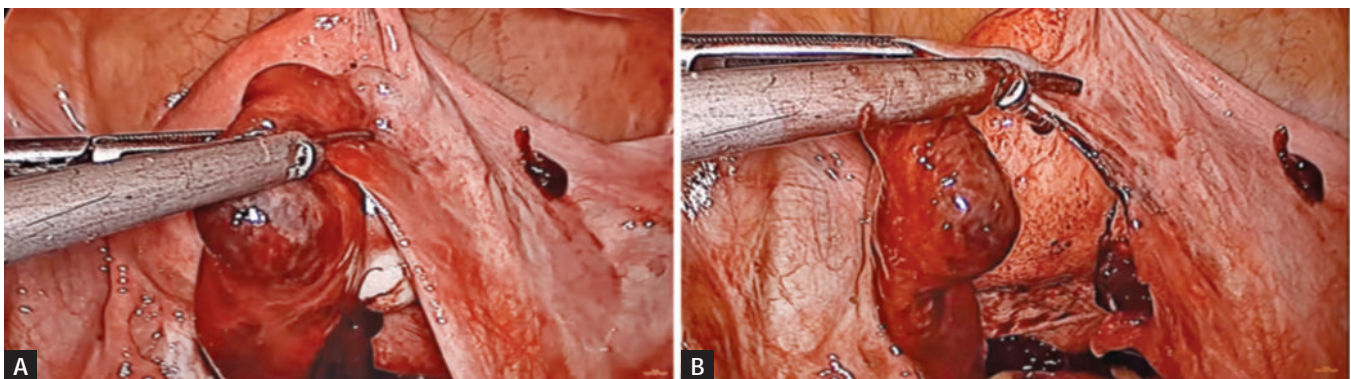


Fig. 3: Suction of trophoblast for unruptured ectopic pregnancy.



Figs. 4A and B: Salpingectomy for tubal ectopic.

Most patients are discharged within 48 hours. There is a higher fertility rate/intrauterine pregnancy rate in subsequent pregnancies with laparoscopic techniques (**Figs. 4A and B**).

Laparoscopic surgery is a good option for ruptured ectopic and a rupture does not necessarily warrant a laparotomy for mild hemoperitoneum (**Fig. 5**). If the patient is hemodynamically stable and initial laparoscopic examination indicates a moderate blood loss, it may be possible to control bleeding laparoscopically and perform any indicated procedures. If the patient is in stage II or stage III shock who has a large hemoperitoneum, laparotomy is the better choice (**Figs. 6A and B**). Managing ruptured ectopic pregnancies involves examining the pelvis, localizing the ectopic, aspirating blood and clots, localizing and controlling the bleeding points, and performing either salpingectomy or in rare situations, an oophorectomy needs to be performed concurrently.

Controlling bleeding is the most critical part of the procedure, and several methods can be attempted sequentially to achieve hemostasis:

- Identification of the bleeding point followed by careful bipolar electrodesiccation
- Injection of vasopressin into the mesosalpinx
- Electrodesiccation of the mesosalpinx



Fig. 5: Mild hemoperitoneum (Laparoscopic appearance).



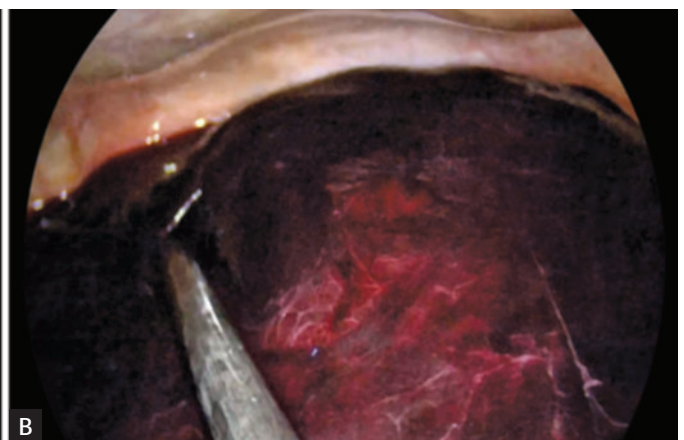
- If bleeding does not stop by these means, then partial or complete salpingectomy is required, depending on the portion of tube involved and the patient's desire for fertility.

After successfully managing the ectopic pregnancy laparoscopically, the patient can be discharged on the second day. The patient should come again for a serum β -hCG 1 week postoperatively to ascertain resolution of the ectopic gestation. The β -hCG level should be either undetectable or very low after 1 week of surgery. If it is above 20 mIU/mL, a repeat blood test is ordered 1–2 weeks later when the β -hCG should be undetectable.

DISCUSSION

Ectopic pregnancy was first discovered in the 11th century, and until the middle of the 18th century, it was usually fatal. John Bard reported the first successful surgical intervention to treat an ectopic pregnancy in 1759.

According to Sepilian, the survival rate in the 19th century was dismal; however, in the beginning of the 20th century, improvement in blood transfusion, anesthesia, and antibiotics contributed to the decrease in the maternal mortality. Ectopic pregnancy currently is the leading cause of pregnancy-related deaths in the first trimester. Sepilian stated that ectopic pregnancy is derived from the Greek word “ektos” meaning out of place, and it refers to the implantation of the fertilized ovum in a location outside of the uterine cavity including the fallopian tubes, cornual or interstitial region of the uterus and fallopian tubes, cervix, ovary, and the abdominal cavity. This abnormally implanted pregnancy grows and draws its blood supply from the site of abnormal implantation, as the gestation enlarges, it creates the potential for organ rupture because only the uterine cavity is designed to expand and accommodate fetal development. The arterial blood supply to the mesosalpinx provided by branches of the ovarian artery that derive directly from the aorta as well as the branches from the uterine artery that derive from the internal iliac artery provides the fallopian



Figs. 6A and B: (A) Ultrasonography (USG); and (B) Massive hemoperitoneum.

tubes with a rich arterial supply that can bleed in the event of a perforated tube, to massive catastrophic hemorrhage and maternal death.

Seeber in 2006 from a study at the University of Pennsylvania reported that the incidence of ectopic pregnancy has increased sixfold since 1970, and is responsible for approximately 9% of all pregnancy related deaths in the United States. The author further reported that a rise in the quantitative beta subunit of hCG of a maximum of 53% over 2 days would be required for a viable pregnancy, and a decline of 21–35% in 48 hours would be mandatory for a diagnosis of spontaneous abortion.

Seeber stated that the absence of an intrauterine pregnancy above an established threshold point of hCG is consistent with an abnormal pregnancy, but does not distinguish a miscarriage from an ectopic pregnancy.

Seeber stated that the symptoms of abdominal pain or pelvic pain and vaginal bleeding are the most common complaints suggestive of ectopic pregnancy. The multiple potential sites of ectopic pregnancies add to the complexity of the diagnosis. Seeber also stated that these symptoms may be erratic and variable, and in some cases, absent. Likewise, such symptoms are nonspecific, and also have been associated with spontaneous abortion, cervical irritation, or trauma, and infection.

Sepilian wrote that the classic triad of amenorrhea, pain, and vaginal bleeding has been strongly associated with the clinical presentation of ectopic pregnancy. However, 50% of patients with ectopic pregnancy present without this triad. They may have symptoms associated with early pregnancy, including nausea, fatigue, lower abdominal pain, painful uterine cramping, recent dyspareunia, and shoulder pain.

Due to increased technology, nowadays most ectopics are diagnosed prior to rupture. Sepilian reported that approximately 20% of ectopic patients are hemodynamically unstable at initial presentation suggesting a ruptured ectopic gestation. There is a 10–25% chances of a recurrent ectopic pregnancy.

Risk factor included progesterone intrauterine device. Increasing maternal age plays important roles in ectopic pregnancy and women aged 35–44 years have a three- to fourfold higher chances as compared to women aged 15–24 years.

Smoking may alter tubal and uterine motility, and is associated with a risk of 1.6–3.5 times more than non-smokers. Other factors associated with an increased risk of ectopic pregnancies include prior abdominal surgery, a ruptured appendix, exposure to diethylstilbestrol, and uterine developmental abnormalities.

Most authors also list prior tubal infection as a cause. Chlamydia may remain asymptomatic and untreated as well as other infectious agents are associated with an increased risk of salpingitis and potential tubal damage. Sepilian

stated that within the last two decades, there has been a more conservative surgical approach to unruptured ectopic gestation. Utilizing minimally invasive surgery, laparoscopy has become the recommended approach in most cases. Laparotomy has been usually reserved for cases where the patients are hemodynamically unstable, or when the surgeon is inexperienced in laparoscopy.

Seeber stated that laparoscopic minimally invasive approach has become the preferred surgical approach, and laparotomy is reserved for hemodynamically unstable patients. Other situations in which the open surgical approach may be preferable include extensive pelvic adhesions where adequate visualization of the ectopic is impossible or extratubal, intra-abdominal ectopic gestation, where risk of injury to other pelvic structures is high. Bruhart reported the first laparoscopic surgery for ectopic pregnancy in 1980.

LAPAROSCOPY VERSUS LAPAROTOMY IN TREATMENT OF ECTOPIC PREGNANCIES

El-Tabbakh reported the results of a trial in Kuwait from March 1999 to October 2001, involving 207 patients to compare laparoscopy versus laparotomy for surgical treatment of ectopic pregnancy. A total of 184 patients were treated by laparoscopy and 23 by laparotomy of the 207 patients with a diagnosis of ectopic pregnancy based on clinical symptoms, history, physical examination, positive serum β -hCG, transvaginal ultrasonography, and an ectopic pregnancy conformed at laparoscopy. Following surgery, patients were followed with serial quantitative β -hCG on Days 4 and 7, then weekly until levels <20 IU/L were obtained. Those treated with laparoscopy had an overall success rate of 98.9%. Moreover, the patients treated by laparoscopy had significantly lower blood loss. Blood transfusion was required by 13% in the laparoscopically treated group compared to 23% in the laparotomy group. All patients had the ectopic pregnancy confirmed by laparoscopy and the decision to proceed with operative laparoscopy or laparotomy depended on the minimal invasive surgery experience of the surgeon on call. There were no intraoperative complications and the duration of surgery ranged from 66 to 72 minutes for both groups. The Kuwait study led the author to conclude that laparoscopic treatment offered benefits superior to laparotomy with less blood loss, therefore, a reduced need for transfusion. The patients experienced less need for analgesia, and a shortened postoperative hospitalization.

Yuen's study included 105 patients in Hong Kong, there were no differences in age, parity, gestational age, and pregnancy of previous laparotomy patients between the groups that underwent a diagnostic laparoscopy prior to laparotomy. The laparoscopy group had a lower incidence of hemoperitoneum (45.9% vs. 75%); Yuen's study was performed in Hong Kong. Yuen stated that operative

laparoscopy has the advantage of combining diagnostic and therapeutic procedures in a single operation is a better approach than laparotomy for the management of tubal pregnancy.

Xiang's study was conducted in Shanghai. Seventy-two of ectopic pregnancy patients were treated laparoscopically. The author concluded that while it was more expensive than laparotomy, the operating time and postoperative hospitalization were shortened. In the laparoscopic studies, the authors stressed reduced blood loss, shortened hospital stay, and reduced need for postoperative analgesia as recurrent positive findings throughout the various studies.




Seeber commented on the laparoscopic treatment of salpingostomy versus salpingectomy. Seeber noted that if salpingostomy had not resulted in the improvement of subsequent pregnancy rate over salpingectomy, then she would have recommended salpingostomy for all ectopic pregnancy patients. However, she states that the data to support this contention are not clear cut. The approximate 50% subsequent pregnancy rate has been noted with either method. The rate of recurrent ectopic pregnancy appeared higher in the salpingostomy (15–10%). The decision to perform salpingostomy as opposed to salpingectomy is often made intraoperatively. In case of severe damage or tubal rupture, tubal conservation is not indicated. Moreover, if tubal bleeding occurs that requires extensive coagulation, then salpingectomy may be preferred due to tubal damage. The success of *in vitro* fertilization has been beneficial for those patients who have had salpingectomy. The formation of adhesions postoperatively has been more extensive with laparotomy. Seeber noted that ectopic pregnancy occurs most frequently as a result of fallopian tube pathology; therefore, there is a risk of recurrence in both the affected and contralateral tube. Women who underwent salpingectomy will have a risk of subsequent ectopic pregnancy in the remaining tube.

As the surgeons gain more experience and training with laparoscopic surgery for ectopic pregnancy, it has become the preferred choice when skill, equipment, and resources are available.

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Contact us

-  World Laparoscopy Hospital
-  Cyber City, Gurugram, NCR Delhi
-  INDIA : +919811416838
-  World Laparoscopy Training Institute
-  Bld.No: 27, DHCC, Dubai
-  UAE : +971523961806
-  World Laparoscopy Training Institute
-  8320 Inv Dr, Tallahassee, Florida
-  USA : +1 321 250 7653