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The Prevalence and Ultrasonographic Features of Ectopic Pregnancy, Rawalpindi, Pakistan

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ABSTRACT

Background: Ectopic pregnancy (EP) continues to be a major contributor to maternal morbidity and mortality throughout early gestation. Early detection using ultrasonography is crucial for effective therapy and optimal outcomes. **Objective:** To find out the prevalence and ultrasonographic characteristics of ectopic pregnancy in patients exhibiting early pregnancy problems. **Materials and Methods:** This cross-sectional study was performed at Health Ways Diagnostic Centre and Life Care Lab in Rawalpindi, Pakistan, from April 2024 to September 2024. One hundred fifty (150) women aged 20-40 years with suspected early pregnancy problems underwent transvaginal and/or transabdominal ultrasonography. Data on clinical presentation, β-hCG levels, and sonographic findings were gathered and analyzed utilizing SPSS and GraphPad Prism. **Results:** In a study of 150 women, 29 cases of ectopic pregnancy were identified, resulting in a prevalence rate of 19.3% (95% CI: 13.8–26.4%). Tubal pregnancies constituted 96.6% of cases, whereas non-tubal pregnancies represented only 3.4% ($p < 0.01$). The predominant age group of patients was 31–35 years, comprising 36.7% of the sample, with the majority of diagnoses made before 9 weeks of gestation. The primary risk factors identified were intrauterine device use (34%), prior ectopic pregnancy (34.4%), and tubal surgery (17%). The predominant ultrasonographic finding was an empty uterus accompanied by an adnexal mass (48.3%), followed by an adnexal mass with free fluid (27.6%) and the hyperechoic ring sign (17.2%). The classic tubal ring was identified in merely 6.9% of instances. **Conclusion:** This study concludes that ectopic pregnancy predominantly originates in the fallopian tubes and is frequently linked to risk factors, including the use of intrauterine devices (IUDs) and previous tubal surgeries. Transvaginal ultrasonography is essential for early and precise diagnosis.

INTRODUCTION

Ectopic pregnancy is taken from the Greek word "Ektopos," which means "out of place," explaining the implantation of the newly formed embryo outside of the endometrial cavity. Ectopic pregnancies are categorized into two types: tubal ectopic pregnancy and non-tubal ectopic pregnancy.[1] Tubal ectopic pregnancy accounts for 95% of the cases, making the tubal implantation the most common form. Most of the tubal implantations occur in the ampulla region (70%), followed by isthmic pregnancy (12%), interstitial pregnancy (11%), and cornual pregnancy (2-3%). Non-tubal ectopic pregnancy includes the ovaries (3%), cervix (<1%), myometrium (<1%), cesarean section scar (<1%), and peritoneal cavity (<1%). [2] In a large population-based U.S study, they found ectopic pregnancy is about 1.6% of pregnancies.[3] At the global level, there were 6.7 million (95% UI: 5.2 to 8.6) incident cases of EP in 2019.[4] A recent study in Islamabad found the prevalence of 1.4% ectopic pregnancy, with pain and vaginal bleeding the most common presenting signs[5]. Another study in Karachi recorded 73 ectopic pregnancy cases among 6346 patients in 2019. [6]

Ectopic pregnancy ruptures are the most common cause of maternal mortality in first trimester of pregnancy with the rate of 9%-14% and incidence of 5%-10% of all pregnancy related deaths [5], [7] another study in Pakistan found 87.67% of diagnosed ectopic pregnancy had tubal rupture, this high rate of rupture increases risk of morbidity and mortality [6] Ectopic pregnancy ruptures, which affect 9–

14% of women who have ectopic pregnancies, are the primary cause of maternal death during the first trimester of pregnancy [8]

There are many risk factors and causes of ectopic pregnancy one study in India found that among 123 of ectopic pregnancy patients 24 patients had previous pregnancy loss and 22 patients had pelvic inflammatory disease making these two the most consistent risk factors[9] There was a statistically significant correlation between ectopic pregnancy and mothers who had a history of tubal surgery, ectopic pregnancy, pelvic inflammatory disease, or abortion.[10]

There are many diagnostic modalities for ectopic pregnancies, the first-line imaging method for suspected ectopic pregnancy is Transvaginal ultrasound, which can detect over 90% of cases, with about 75% of them being found on the initial scan [11] Transvaginal ultrasonography and serial HCG measurement together offer a diagnostic accuracy of over 95% for ectopic pregnancy in women who experience pain or bleeding during the early stages of pregnancy[2] serum β-hCG has magnificent rule in diagnosis of ectopic pregnancy, serum β-hCG levels usually double every 48 to 72 hours in a viable intrauterine pregnancy, they often rise more slowly or plateau in an ectopic pregnancy[12]

Methotrexate (MTX) is used for stable patients without signs of rupture, low and/or plateauing β-hCG, small ectopic mass size, and no fetal cardiac activity[2]. Single-dose or multi-dose MTX protocols exist; success is higher when β-hCG is below institution-defined thresholds (often < 5,000 mIU/mL) and mass size < ~4 cm[13] If there is hemodynamic instability, rupture, a high risk of rupture, a large ectopic size, or MTX contraindications, surgery is necessary.[2] Surgery options include salpingectomy, which removes the fallopian tube, and salpingostomy, which makes an incision in the tube to remove an ectopic while leaving the tube intact. The extent of damage, desire for future fertility, and tube status all influence the decision.[2] Laparoscopic surgery is preferred over laparotomy when possible due to reduced blood loss, shorter hospital stays, and faster recovery times. [2]

Salpingostomy is frequently preferred over salpingectomy for women who wish to maintain their fertility, especially if the contralateral tube is in good condition.[2] For less common ectopic sites (such as the cervical, cesarean scar, and interstitial sites), there are also more recent or complementary techniques being researched. These include high-intensity focused ultrasound (HIFU), uterine artery embolization (UAE), and local injection of methotrexate.[8]

Given that ectopic pregnancy is one of the causes of maternal morbidity and mortality in women of reproductive age, the goal of the current study is to ascertain its frequency and sonographic appearance. Due to this increased risk, an ultrasound test performed during the first trimester of pregnancy is clinically significant for accurate diagnosis and treatment planning. Although the diagnostic criteria were not clear, numerous researchers have examined the function and effectiveness of ultrasound in detecting ectopic pregnancy. While diagnostic imaging tools like CT and MRI scans can also be used to look into suspected cases of ectopic pregnancy, ultrasound is recommended because it doesn't emit radiation. Therefore, pregnant patients can safely use it.

MATERIALS AND METHODS

The Institutional Research Board Committee of Zohra Institute of Health Sciences, Rawalpindi (an affiliated college of GCUF), with study locations at Health Ways Diagnostic Centre & Life Care lab, approved this research. (Ref no: ZIHS/IRB/2024/1030). Informed consent in written form was acquired from each participant. Patient information was anonymised and maintained to comply with data protection regulations.

This cross-sectional study was carried out in the Department of Obstetrics and Gynecology in collaboration with the Department of Radiology at Health Ways Diagnostic Centre and Life Care Lab, Rawalpindi, Pakistan, from April 2024 to September 2024. We included all women between the ages of 20 and 40 who had a transvaginal and/or transabdominal pelvic ultrasonography throughout the research period and were suspected of having early pregnancy problems.

Inclusion Criteria

- All pregnant patients with gestational age ≤12 weeks who turned up for ultrasonography.
- Positive pregnancy test (serum β-HCG levels higher than 100,000 IU/L) and clinical suspicion of ectopic pregnancy (abdominal pain, vaginal bleeding, or amenorrhea).
- Patients who received pelvic ultrasonography at our facility and possessed comprehensive data.
- Patients with a history of ectopic pregnancy, a familial predisposition to ectopic pregnancy, a history of tubal surgery or tubal disease, and those who have previously utilized contraceptive tablets were included.

Exclusion Criteria

- Hemodynamically unstable patients should be brought directly to emergency surgery without preoperative ultrasonography, unless a separate report is required.
- Molar pregnancy or intrauterine pregnancy was verified before the ultrasound examination.
- Insufficient records or absent critical factors (e.g., missing ultrasound images/reports).

Data Collection

A convenient, non-probability sampling technique was used to determine the sample size, which was 150 cases. Clinical data, including patients' age, signs and symptoms, quantitative β-HCG levels, and gestational age by last menstrual period (LMP), were obtained using a predesigned data extraction form. Ultrasound scans were performed with the help of a Toshiba Xario machine with transabdominal and transvaginal transducers having frequencies of 3.5 MHz and 5MHz.Data regarding GA, empty uterus, presence of adnexal mass, free fluid in pelvis, inhomogeneous mass or blob sign in adnexal region, and hyper-echoic ring around gestational sac on ultrasound images were recorded. The opinions of the consultant radiologist were taken into consideration for all sonographic findings.

The collected data were analyzed using both GraphPad

Prism and SPSS software. GraphPad Prism was used for visual representation of results (e.g., bar graphs), while SPSS was used for statistical comparisons and descriptive statistics. The analysis consists of descriptive analysis, frequency analysis, and chi-square analysis.

Ultrasound Protocol

The patient was positioned supine and transverse, and longitudinal grayscale imaging was carried out with both static images and video clips in all patients. A full bladder is often required for a transabdominal ultrasound, as it enhances visualization by pushing bowel loops out of the way. The ultrasound probe was placed on the lower abdomen to capture images of the uterus, ovaries, and fallopian tubes. For more detailed imaging, a transvaginal ultrasound was performed, which offers a closer view of pelvic structures. During the transvaginal ultrasound, the patient was positioned in a lithotomy or modified lithotomy position with knees bent and feet together. The transvaginal approach can help visualize the fallopian tubes and identify ectopic pregnancies that may not be visible with a transabdominal ultrasound. Color and spectral analysis, and Doppler investigations were carried out in order to further define the results on grayscale images. Patients with no clear diagnosis on transabdominal scan were examined with transvaginal examination.

RESULTS

A total of 150 women with suspected early pregnancy complications were enrolled in the study. Of them, 29 were identified with ectopic pregnancy using ultrasonography, resulting in a prevalence of 19.3%. Out of 29 EP patients, 28 patients (96.6%) have tubal ectopic pregnancy, and only 1 patient (3.4%) has a non-tubal ectopic pregnancy (Table#1). The predominant age groups of patients were 26–30 years (32.7%) and 31–35 years (36.7%) (Figure#1), with a majority being multigravida. Five categories were established for EP patients based on gestational age: 1-3 weeks, 4-6 weeks, 7-9 weeks, and 10-12 weeks. The majority, 41% of patients, presented at 4-6 weeks, whereas 35% presented between 7-9 weeks. The majority of the patients were identified before 9 weeks via ultrasonography (Figure#2). The study indicates that IUD was the predominant risk factor in 34% of instances. Tubal surgery was identified in 17% of patients, while contraceptive pills constituted a risk factor in 20.00% of women. (Figure#3). The study indicates that a prior ectopic pregnancy was the most common presentation in 34.38% of cases, although B HCG levels exceeding 100,000 IU/L were observed in 28.88% of patients (Figure#4).

Table 1

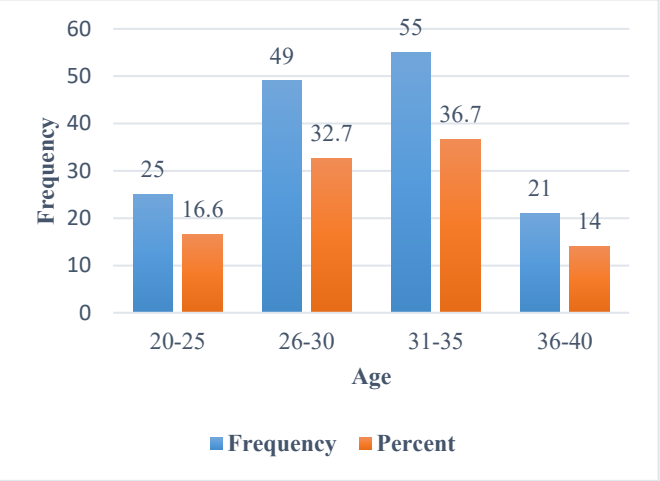
Statistical Analysis of Ectopic Pregnancy & its Types in the Studied Patients

Distribution	Normal Pregnancy	Ectopic Pregnancy	Tubal EP	Non-Tubal EP
Frequency	121	29	28	1
Percent	80.7%	19.3%	96.6%	3.4%
95% CI	–	13.8 – 26.4	–	–
p-value	–	–	<0.01	–
Total	150	150	29	29

EP=Ectopic Pregnancy

Figure 1

Age Distribution of Studied Patients



Ultrasonography identified 29 ectopic pregnancies among 150 women, resulting in a prevalence of 19.3% (95% CI: 13.8–26.4%). In the analysis of 29 ectopic pregnancies, a statistically significant difference ($p < 0.01$) was observed between Tubal EP and Non-Tubal EP, indicating that tubal implantation was the primary site for ectopic pregnancy in this study.

Figure 2

Gestational Age of Studied Ectopic Pregnancy Patients

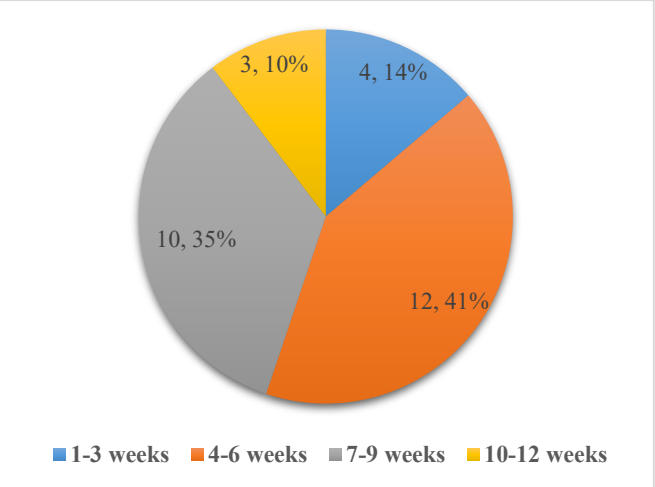


Figure 3

Risk Factors among Studied Ectopic Pregnancy Patients

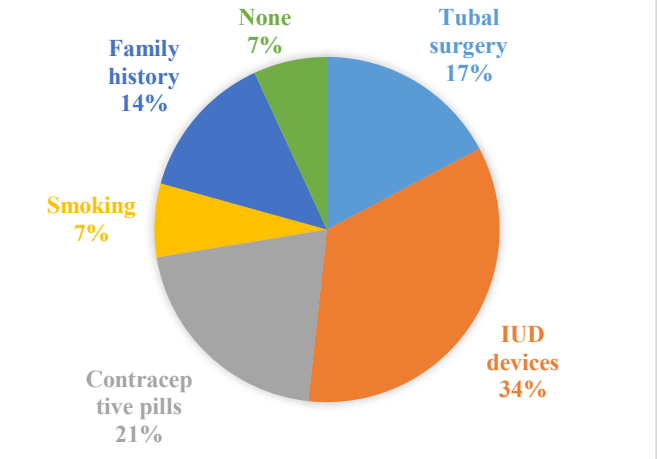


Figure 4
Clinical Presentation of Studied Patients with Ectopic Pregnancy

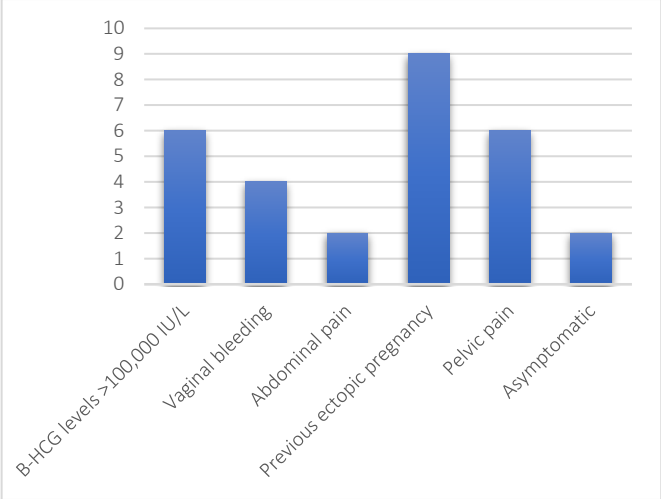


Table 2
Ultrasound Evaluation of Studied Patients with Ectopic Pregnancy

Sonographic Findings	Frequency	Percentage%
Mass with a hyperechoic ring around the gestational sac	5	17.2%
Empty uterus with adnexal mass	14	48.3%
Adnexal mass with empty uterus and free fluid in the pelvis	8	27.6%
Tubal ring sign	2	6.9%

Ultra-sonographic assessment revealed that the predominant characteristic was an empty uterus accompanied by an adnexal mass, which was identified in 14 (48.3%) of the ectopic pregnancy cases, followed by an adnexal mass accompanied by an empty uterus, and free pelvic fluid was observed in 8 cases (27.6%). A mass with a hyperechoic ring surrounding the gestational sac was observed in 5 cases (17.2%). The classic “tubal ring” sign was identified only in 2 (6.9%) patients. The fallopian tube was the most common location of ectopic implantation.

DISCUSSION

Among the 150 early pregnancy cases assessed in this cross-sectional study at the Life Care Lab & Medical Diagnostic Center in Rawalpindi, 29 cases—or 19.3% of the sample—were confirmed to be ectopic pregnancies (EP). Tubal cases made up the majority of cases (96.6%), consistent with established literature that tubal implantation is the primary cause of ectopic pregnancies, highlighting its clinical significance in the assessment of early pregnancy [14]

The majority of EP cases were women aged 31-35 years (55.2%). This is aligned with the previous study, which also reported higher EP frequency in women over 30 years, where 57.7% cases were among women aged 31-40 years[5]

The most common findings in this study were vaginal bleeding (13.8%), pelvic pain (20.7%), elevated β-hCG levels (20.7%), and a history of prior EP (31%). Fewer than half of patients usually present with all three symptoms, even though the classic triad of abdominal pain, vaginal bleeding, and amenorrhea is widely recognized [15]. The fact that 6.9% of the patients in this cohort were asymptomatic highlights the importance of routine early imaging because morbidity is decreased by incidental detection before rupture.

The most common risk factor was the use of an intrauterine device (IUD) (33.3%), which was followed by the use of contraceptive pills (20%), previous tubal surgery (16.7%), family history (16.7%), and smoking (6.7%). Even though IUD failures are uncommon, they disproportionately result in EP when compared to intrauterine pregnancies, according to Medscape's clinical overview

Sonographically, every case showed an empty uterus; 48.3% showed an empty uterus plus adnexal mass, 27.6% showed an empty uterus with adnexal mass and free fluid, and 17.2% showed the hyperechoic "bagel/tubal ring" sign; 6.9% had a typical tubal ring. According to Winder et al. (2015), the tubal ring is a more specific but less frequently seen sign, even though adnexal masses and free fluid are the most typical findings[16]. Madani et al. added that to avoid diagnostic pitfalls, ultrasound should always be interpreted in conjunction with β-hCG trends.[17]

The study's high rate of early detection (nearly 90% <10 weeks) highlights the value of transvaginal ultrasound as a common adjunct in cases where transabdominal views are unclear. This aligns with international recommendations emphasizing early ultrasound to expand conservative management options, such as methotrexate therapy in stable cases. On the other hand, in cases of rupture or instability, surgical management is still required; laparoscopy is preferred over laparotomy due to its lower morbidity rate.[17]

CONCLUSION

According to this study, EP is primarily tubal, typically manifests in women between the ages of 31 and 35, and is commonly linked to previous tubal surgery and IUD use. Although tubal ring signs are less common, the classic sonographic pattern still reveals an empty uterus, accompanied by adnexal pathology. The management options and results are greatly enhanced by early TVS-based detection. These results underline the significance of integrated ultrasound and risk-factor assessment in early pregnancy care and support previous research

This study's systematic sonographic evaluation and consistent diagnostic criteria are among its strong points. The single-center design, small sample size, and some misclassification of symptoms and risk factors (e.g., prior EP listed under presenting complaints) are among the limitations. Furthermore, biochemical imaging integration was hindered by the absence of standardized β-HCG discriminatory thresholds. However, the validity of the findings is supported by their agreement with the international literature

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