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Original Research Article

Ectopic pregnancy: an analysis of risk factors, diagnosis and management

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ABSTRACT

Background: Ectopic pregnancy (EP), implantation outside the uterine cavity, is a leading cause of first-trimester maternal morbidity and mortality. Tubal pregnancies constitute over 90% of cases, with risk factors including pelvic inflammatory disease (PID), assisted reproductive technologies (ART), and delayed childbearing. Advances in transvaginal ultrasonography and β-hCG assays have improved early detection, but challenges in diagnosis and management persist. This study examines trends, risk factors, and management outcomes of EP at Chettinad medical college, Kelambakkam.
Methods: A retrospective, non-interventional study of 50 EP cases (Jan 2023-June 2024) analyzed patient demographics, clinical presentations, and treatment outcomes. Descriptive and inferential statistics (Chi-square test, $p<0.05$) were used for analysis via SPSS.
Results: The mean age was 29.02 years (23-35). Abdominal pain (13 cases) was the most frequent symptom, followed by the classic triad (12 cases). Prior EP (13 cases), PID, and ART were primary risk factors. Unruptured EPs (17 right, 12 left) were more common. Medical management (19 cases) was initially used, but 15 required surgery post-failure. No significant correlation was found between risk factors and symptoms (Chi-square=57.64, $p=0.85$).
Conclusions: EP predominantly affects reproductive-age women, with abdominal pain as the primary symptom and prior EP as the main risk factor. Diagnostic advancements improve outcomes, but challenges remain in optimizing medical management and recurrence prevention. Future research should refine diagnostic markers and treatment strategies to reduce morbidity and mortality.

Keywords: Ectopic pregnancy, Tubal pregnancy, Risk factors, Diagnosis, Management, Maternal morbidity

INTRODUCTION

Ectopic pregnancy (EP) is a condition in which a fertilized egg implants and grows outside the uterine cavity, most commonly within the fallopian tube, although other less common sites include the ovary, cervix, or abdominal cavity. It is a significant cause of maternal morbidity and mortality in the first trimester, accounting for 1-2% of all pregnancies globally. The fallopian tube is involved in over 90% of ectopic pregnancies, making tubal pregnancies the most prevalent type.[1,2] Despite advances in medical and surgical interventions, EP remains a critical issue in reproductive health due to its potential complications, including tubal rupture, haemorrhage, and subsequent infertility.

The incidence of EP has fluctuated in recent years, influenced by multiple factors. A notable rise is observed in some regions, attributed to the increased prevalence of PID, the widespread use of ART, and delayed childbearing. Early diagnosis and appropriate management are key to preventing life-threatening outcomes and preserving fertility.[3] The evolution of diagnostic methods, particularly the integration of high-resolution transvaginal

ultrasonography and serum beta-human chorionic gonadotropin (β-hCG) assays, has significantly improved the ability to detect ectopic pregnancies before the occurrence of complications.[4]

The study of EP is crucial because of its dual impact: the immediate threat to maternal health and the long-term implications for reproductive potential. A delay in diagnosis can result in catastrophic complications, such as tubal rupture and life-threatening haemorrhage, underscoring the importance of early detection and timely intervention. Furthermore, the psychological burden associated with EP and the impact on future fertility highlight the need for comprehensive research and effective management strategies.[5] Identifying risk factors is essential to improving early detection and preventive care for women at higher risk. Conditions such as a history of PID, prior EP, tubal surgery, and certain fertility treatments have been strongly associated with increased risk.[6] Advances in diagnostic techniques, particularly in imaging and biochemical markers, have greatly enhanced the precision of early diagnosis. However, challenges persist in differentiating EP from other causes of early pregnancy complications, especially in settings with limited access to diagnostic tools.

This analysis aims to explore the risk factors, diagnostic strategies, and management approaches associated with EP. By synthesizing current evidence, it seeks to inform clinical practice, improve patient outcomes, and identify areas where further research is required to address existing knowledge gaps.

Aim

Aim of the study was to analyze recent trends in ectopic pregnancies, focusing on cases managed at Chettinad medical college, with an emphasis on patient demographics, risk factors, comorbidities, and management strategies.

METHODS

Study design

The study was a non-interventional, retrospective analysis conducted to assess recent trends in ectopic pregnancies. Data were collected from medical records of patients managed at Chettinad hospital and research institute.

Study duration

The study was conducted over a period of 18 months, covering cases managed from January 2023 to June 2024.

Sample size

The sample consisted of 50 patients who were diagnosed and managed for EP at CHRI between January 2023 and June 2024.

Study methodology

Data were collected retrospectively from the medical records of patients treated for EP during the specified study period. EP was defined as the implantation of a gestational sac outside the uterine cavity. The clinical presentations, including symptoms such as lower abdominal pain and vaginal bleeding, were recorded and correlated with diagnostic findings. The patients' age, parity, risk factors, comorbidities, and presenting symptoms were documented. Risk factors such as previous EP, fallopian tube damage, history of pelvic surgeries, PID, smoking, advanced maternal age (>35 years), use of ART, and other contributing factors were analyzed.

Diagnosis was confirmed through clinical evaluation, imaging modalities (primarily ultrasonography), and serum beta-human chorionic gonadotropin (β-hCG) levels. The management approaches employed for the patients were categorized as medical, surgical, or expectant, depending on the clinical presentation, gestational sac size, and EP location. Outcomes were evaluated to determine the effectiveness of each treatment approach in terms of resolution without morbidity or mortality.

Study outcomes

The primary outcomes of the study were to analyze the recent trends in EP, with a focus on patient demographics, risk factors, and clinical management strategies. The study aimed to improve the prediction and management of ectopic pregnancies, thereby reducing associated morbidity and mortality.

Ethical considerations

The study was conducted retrospectively, involving only patients who had been diagnosed and treated for EP at CHRI. No ethical limitations were identified as the data collection involved analysis of existing medical records, ensuring patient confidentiality was maintained throughout the study.

Statistical analysis was conducted to evaluate trends, associations, and outcomes related to ectopic pregnancies using a combination of descriptive and inferential methods. Patient demographics, such as age, parity, and comorbidities, were summarized using means, medians, and standard deviations, while categorical variables, including presenting symptoms, risk factors, and management approaches, were expressed as frequencies and percentages.

Associations between risk factors (e.g., prior EP, PID, smoking) and clinical presentation were assessed using chi-square tests or Fisher's exact test, as appropriate. Statistical analyses were performed using SPSS version 26.0, with a p value of<0.05 considered statistically significant.

RESULTS

The mean age of patients with ectopic pregnancies is 29.02 years, with a median of 29.0 years. The standard deviation of 3.20 years reflects some variability in patient ages, while the range (23 to 35 years) indicates that most patients fall in their reproductive years, with a slight skew towards the late 20s. The most commonly reported symptom was pain abdomen (13 cases), followed closely by triad (12 cases) and spotting PV + amenorrhea (11 cases). A smaller group experienced pain abdomen + amenorrhea (7 cases).

Table 1: Patient age and clinical presentation in EP cases.

Characteristics	Value
Age (in years)	
Mean	29.02
Median	29.0
Standard deviation	3.20
Range	23-35
Clinical symptoms (n=5)	
Pain abdomen	13
Triad (Pain + amenorrhea + spotting PV)	12
Spotting PV + amenorrhea	11
Pain abdomen + amenorrhea	7

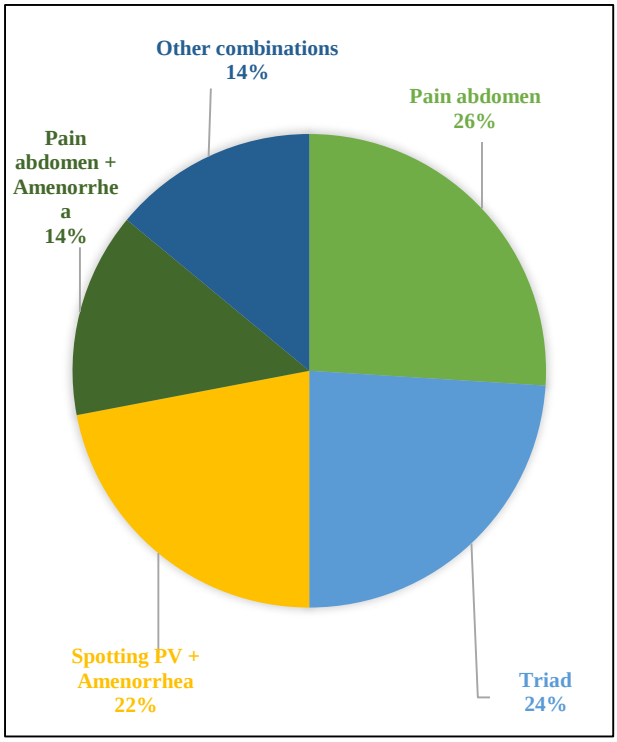

Figure 1: Symptom distribution.

The leading risk factor is previous 1 EP (13 cases), underscoring recurrence risks. PID accounts for 9 cases, followed by ART at 7 cases. Other less common factors include sterilization, IUCD use, and previous multiple ectopic pregnancies.

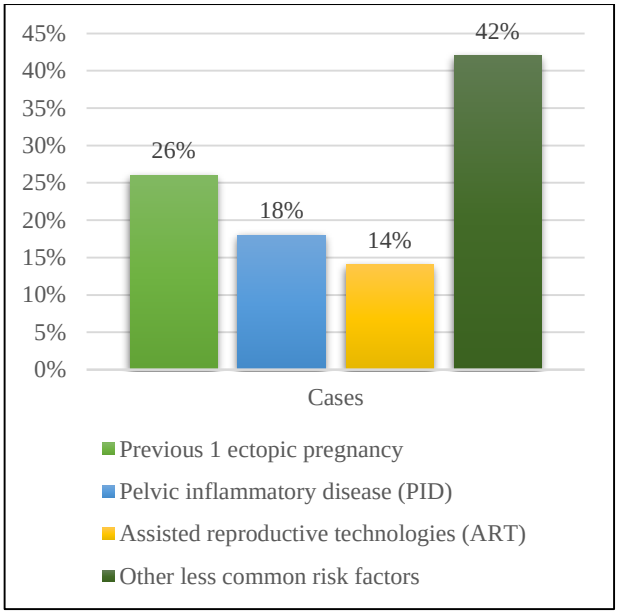

Figure 2: Risk factor distribution.

The distribution of ultrasonography (USG) findings among patients highlights key patterns in ectopic pregnancies. The most frequently observed finding is right unruptured ectopic pregnancies, accounting for 17 cases, followed by left unruptured ectopic pregnancies with 12 cases. Cases involving ruptured ectopic pregnancies are less common, with left ruptured and right ruptured ectopic pregnancies each contributing 5 cases. Additionally, specific cases of right ruptured ectopic pregnancies were noted in 4 instances.

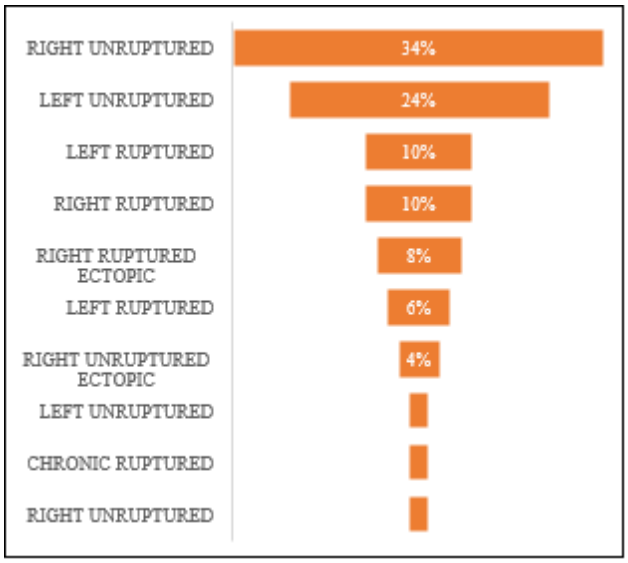

Figure 3: USG findings.

A preference for medical management (19 cases) is evident, followed by surgical management in 14 cases. Notably, 15 cases required medical failure leading to surgical management, suggesting that initial medical interventions may not always be effective.

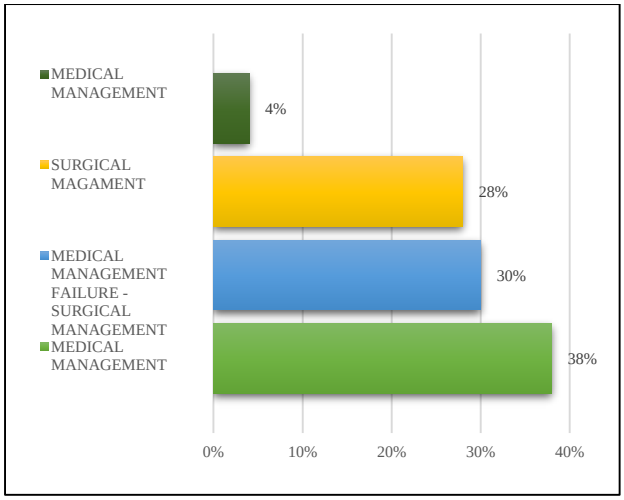

Figure 4: Management approaches.

To assess the association between risk factors and symptoms-Chi-square value: 57.64, degrees of freedom: 70 and p value=0.85 (no significant association).

DISCUSSION

The results of this study align with findings from previous research that ectopic pregnancies predominantly affect women in their reproductive years. The mean age of 29.02 years observed in our study is consistent with the findings of Barnhart et al., who reported that ectopic pregnancies are most common in women aged 26-30 years.[1] This age group represents peak fertility years, often coinciding with exposure to risk factors such as pelvic infections or the use of ART. Additionally, the narrow standard deviation and age range observed in our study reflect a homogenous demographic profile, which is supported by studies indicating similar trends in comparable populations.[2] The nonspecific symptoms observed in our study, such as abdominal pain, vaginal spotting, and the classic triad (pain, amenorrhea, and bleeding), reveal the diagnostic challenges associated with ectopic pregnancies. These findings are supported by Tay et al who identified abdominal pain as the most common symptom, often accompanied by bleeding or amenorrhea.[5] The variability in symptoms emphasizes the need for thorough clinical evaluation, especially in settings where access to diagnostic tools such as ultrasonography may be limited.

The recurrence of EP as the leading risk factor in our study (13 cases) mirrors findings in studies by Bouyer et al who identified prior EP as a significant predictor of recurrence.[3] Similarly, PID (9 cases) and ART (7 cases) were notable contributors, consistent with prior research linking these factors to tubal damage or dysfunction.[6] The association of ART with ectopic pregnancies, as seen in our study, has been well-documented, with factors such as altered tubal motility or embryo transfer procedures contributing to increased risk.[7] Lesser-cited risk factors, such as sterilization and IUCD use, were also identified in our cohort, supporting the findings of earlier studies that emphasize the multifactorial nature of EP risk.[8]

The predominance of unruptured ectopic pregnancies in our study (17 right-sided and 12 left-sided) reflects the efficacy of early diagnostic techniques, including high-resolution transvaginal ultrasonography. Condous et al similarly reported that early USG evaluation enables the identification of ectopic pregnancies before rupture, significantly reducing morbidity.[9] However, the presence of ruptured cases (5 on each side) in our cohort highlights the potential for delayed diagnosis, particularly in settings with limited access to diagnostic resources or where patients present late.

The preference for medical management (19 cases) observed in our study aligns with trends reported in the literature, where methotrexate-based regimens are favoured for their non-invasive nature and efficacy in carefully selected cases.[10] However, the relatively high number of medical failures necessitating surgical intervention (15 cases) show the need for stringent patient selection criteria and close monitoring of medical management. Surgical management, employed in 14 cases, remains essential for advanced or ruptured ectopic pregnancies. Studies by Jurkovic et al. similarly highlight the complementary roles of medical and surgical approaches, emphasizing the importance of individualized treatment based on clinical and diagnostic parameters.[11] The chi-square test in our study revealed no statistically significant association between risk factors and symptoms (Chi-square value: 57.64, p=0.85). This lack of significance is consistent with findings from similar studies, which also report the heterogeneous nature of clinical presentations irrespective of specific risk factors.[12] The need for larger sample sizes and advanced statistical modelling is evident to better understand these complex relationships.

The findings from this study align with global trends, emphasizing the importance of early diagnosis and personalized management strategies in EP care. Similar to the recommendations by Barnhart et al., future research should focus on enhancing the diagnostic accuracy of biochemical markers, such as beta-hCG, and evaluating novel therapeutic approaches to improve the efficacy of medical management.[13] Additionally, the role of preventive measures, such as reducing the incidence of pelvic infections and ensuring the safe application of ART, warrants further exploration.

EP occurs when an embryo implants outside the uterine cavity, with the most common site being the fallopian tubes, accounting for 95-98% of cases. Tubal ectopic pregnancies (tEP) can be further classified based on specific locations within the tube, such as the ampullary, isthmic, fimbrial, and interstitial regions. Less frequently, ectopic pregnancies may occur in other locations, including the ovary, cervix, or abdominal cavity, as well as within a cesarean scar or in the rudimentary horn of a

malformed uterus. Rarely, intramural pregnancies (within the myometrium) or heterotopic pregnancies (simultaneous intrauterine and ectopic pregnancies) are observed. Management of EP is tailored to the patient's clinical stability and includes expectant, medical, and surgical approaches. Expectant management is suitable for stable patients with low and declining β-hCG levels and small, non-viable ectopic pregnancies, requiring close monitoring. Medical treatment with methotrexate, a drug that inhibits rapidly dividing cells, is effective for early and uncomplicated cases, particularly when β-hCG levels are below 1500 IU/L. For cases involving tubal rupture, hemodynamic instability, or failure of other treatments, surgical intervention becomes necessary. Laparoscopy is the preferred surgical approach, with options including salpingectomy, which removes the entire affected tube, or salpingostomy, which preserves the tube but carries a risk of residual trophoblastic tissue. These management strategies, combined with advances in early diagnosis, have significantly improved outcomes for women experiencing this potentially life-threatening condition.[14]

This study has some limitations. The small sample size (n=50) makes it difficult to apply the findings to larger populations. As a retrospective study, it relies on medical records, which may have missing or incomplete data, affecting accuracy. The study also lacks long-term follow-up, so we cannot assess future fertility outcomes or the risk of recurrence. Some important factors like smoking, diet, genetics, and healthcare access were not analyzed, which may influence the results. Since the study was conducted at a single hospital (Chettinad medical college, Kelambakkam), the findings may not reflect other regions or healthcare settings. Differences in how doctors diagnose and manage ectopic pregnancies could also lead to variations in treatment success. While the study looks at medical vs. surgical management, it does not explore why some medical treatments (e. g., methotrexate) fail. Also, the statistical methods used help find associations but do not predict outcomes in detail. Future studies with larger, multi-center, and long-term research are needed to confirm these findings and improve treatment strategies for EP.

This study reinforces the critical importance of comprehensive risk assessment, timely ultrasonography, and individualized management in improving outcomes for ectopic pregnancies. By integrating findings from comparative studies and advancing research, the medical community can continue to optimize care for this high-risk condition.

CONCLUSION

EP remains a significant cause of maternal morbidity and, in some cases, mortality, particularly during the first trimester of pregnancy. This study highlights key demographic, clinical, and management trends associated with ectopic pregnancies, offering valuable insights for improving patient outcomes. The findings emphasize that ectopic pregnancies primarily affect women in their late 20s to early 30s, coinciding with peak fertility years. Risk factors such as prior ectopic pregnancies, PID, and ART play a central role in the etiology, reinforcing the importance of comprehensive patient histories and risk stratification. The diverse clinical presentations observed, ranging from abdominal pain to the classic triad of symptoms, underline the diagnostic challenges inherent to ectopic pregnancies. The role of ultrasonography as a cornerstone of early diagnosis is evident, enabling timely identification of both unruptured and ruptured ectopic pregnancies. Management approaches continue to evolve, with medical management being the preferred strategy in appropriate cases. However, the notable rate of medical failures transitioning to surgical management highlights the need for refined patient selection criteria and vigilant monitoring.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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