

Evaluation of Serum Interleukin 15 in Women with Ectopic Pregnancy and Missed Miscarriage in Comparison with Normal Pregnancy

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Abstract—Background: Ectopic pregnancy and missed miscarriage are among the leading causes of early pregnancy complications and maternal morbidity. Differentiating these from viable intrauterine pregnancy remains a diagnostic challenge, particularly in early gestation when ultrasound findings are inconclusive. Interleukin-15 a cytokine involved in immune modulation and trophoblast regulation has recently been proposed as a potential biomarker for early pregnancy outcomes. **Aim of the Study:** To evaluate the role of serum interleukin-15 as a biomarker in differentiating ectopic pregnancy and missed miscarriage from viable intrauterine pregnancy during early gestation. **Methodology:** Cross-sectional comparative observational study was conducted at Babil Teaching Hospital of Maternity and children from November 2024 to November 2025. Ninety pregnant women with gestational age between 6–8 weeks were enrolled and divided equally into three groups: viable intrauterine pregnancy, ectopic pregnancy, and missed miscarriage (30 each). Clinical assessment, ultrasound, and laboratory investigations were performed, and serum IL-15 levels were measured using the ELISA method and compared. **Results:** Mean serum IL-15 levels were significantly higher in ectopic pregnancy (60.91 ± 7.94 pg/mL) and missed miscarriage (56.47 ± 10.94 pg/mL) compared with viable intrauterine pregnancy (47.90 ± 9.66 pg/mL) ($p < 0.001$). However, no significant difference was found between ectopic pregnancy and missed miscarriage ($p = 0.094$). ROC analysis showed that IL-15 had good diagnostic accuracy in differentiating ectopic pregnancy from viable intrauterine pregnancy (AUC = 0.827, sensitivity = 92%, specificity = 63%) and fair accuracy for missed miscarriage versus viable IUP (AUC = 0.787, sensitivity = 80%, specificity = 70%). **Conclusions:** the current study conclude that Serum IL-15 levels were significantly elevated in ectopic pregnancy and missed miscarriage in comparison with viable intrauterine pregnancy.

I. INTRODUCTION

1. Ectopic Pregnancy

1.1. Background

Ectopic pregnancy is the implantation of a fertilized egg in a place other than the uterine cavity, such as the fallopian tubes (about 97.7% of cases), cervix, ovary, cornual area of the uterus, or abdominal cavity. The ampulla (80%) is the most common site of implantation in tubal pregnancies, followed by the isthmus (12%), fimbria (5%), cornua (2%), and interstitia (2–3%) (1).

The term "ectopic" comes from the Greek word *ektopos*, which means "out of place," and the fetus develops and gets its blood supply from a site of aberrant implantation. Because only the uterine cavity is intended to expand and support fetal development, a bigger gestation raises the risk of organ rupture. Massive bleeding, infertility, or death can result from an ectopic pregnancy (2).

Abdominal pregnancies make up 1.4%, and ovarian and cervical locations each make up 0.2% of ectopic pregnancies, which are uncommon outside of the fallopian tubes. Some pregnancies implant in the cervix (<1%) or in previous cesarean delivery scars 0.01% or a rudimentary uterine horn; although these may be technically within the uterus, they are not considered normal intrauterine pregnancies (3).

About 80% of ectopic pregnancies are found on the same side as the corpus luteum when present. In the absence of modern prenatal care, abdominal pregnancies can present at an

advanced stage (>28 weeks) with catastrophic rupture and bleeding (4). The understanding and management of ectopic pregnancy have evolved significantly—from a near-certain fatality in the 19th century to a condition that can be effectively managed today (5).

1.2. Epidemiology:

Ectopic pregnancies constitute about 1–2% of all pregnancies. The incidence is influenced by factors like pelvic inflammatory disease, prior pelvic surgeries, and the use of fertility treatments—with a noted increase in developed countries due to assisted reproductive technologies (6). In the U.S., the incidence has increased from 4.5 cases per 1000 pregnancies in 1970 to roughly 1 in 40 pregnancies (or about 25 cases per 1000) as reported by the CDC (7). Similar trends have been observed globally, with varied estimates in Africa based on hospital data (8). Women older than 40 years have a significantly higher risk, with an adjusted odds ratio of 2.9 (9). Local data from Iraq estimate an incidence rate of 2.217 per 1000 of the population at risk (10).

2. Missed Miscarriage

2.1. Definition

Missed miscarriage, also known as silent or delayed miscarriage, is characterized by fetal demise without the immediate expulsion of the gestational tissue, the products of conception remain within the uterus, often discovered incidentally during routine prenatal examinations or when the expected progression of the pregnancy fails to occur (32).

2.2. Epidemiology

Missed miscarriage occurs in approximately 1–5% of clinically recognized pregnancies. The precise incidence may fluctuate based on the diagnostic standards used and the group studied. Many cases remain undetected until a scheduled ultrasound reveals the absence of fetal cardiac activity despite the presence of retained gestational material (33).

2.3. Pathophysiology and Risk Factors:

The underlying mechanisms of missed miscarriage are multifactorial and may include:

- **Chromosomal Abnormalities:** The majority of missed miscarriages are attributed to chromosomal anomalies in the embryo, which can result from errors during cell division (34).
- **Impaired Placental Development:** Inadequate trophoblast invasion and poor placental formation may contribute to the failure of the pregnancy to progress (35).
- **Immunological Factors:** Dysregulation of cytokines—such as an imbalance in IL-15 levels—can affect the immune tolerance necessary for maintaining a healthy pregnancy. A deficiency in supportive cytokine signaling might lead to the silent demise of the fetus (36).
- **Maternal Factors:** Conditions such as uncontrolled diabetes, thyroid dysfunction, or advanced maternal age have been associated with an increased risk of missed miscarriage (37).

3. Interleukin-15 (IL-15)

3.1. Biological Profile and Functions

Interleukin-15 (IL-15) is a cytokine that plays a crucial role in the regulation of the immune system. It is a member of the four α -helix bundle family of cytokines and shares structural similarities with IL-2. IL-15 is produced by a variety of cells, including monocytes, macrophages, fibroblasts, and epithelial cells. Its principal functions include:

- **Regulation of Natural Killer (NK) Cells:** IL-15 is essential for the development, survival, and activation of NK cells. These cells are vital in the early immune response and in maintaining tissue homeostasis.
- **T-Cell Proliferation and Survival:** It promotes the proliferation and survival of CD8⁺ T cells, thereby enhancing cellular immune responses.
- **Anti-Apoptotic Effects:** IL-15 has been shown to provide survival signals to various immune cells, preventing premature apoptosis and contributing to sustained immune surveillance (42).

3.2. IL-15 in the Context of Pregnancy

During pregnancy, the immune system is uniquely modulated to support the developing fetus while still protecting the mother from infections. IL-15 is one of the key cytokines involved in establishing and maintaining this delicate balance (43).

- **Uterine Natural Killer (uNK) Cells:**

IL-15 is highly expressed in the decidua (the uterine lining during pregnancy) and is crucial for the recruitment and function of uNK cells. These cells are not only important for defending against pathogens but also play a pivotal role in remodeling the uterine vasculature, which is essential for proper placental development and fetal growth (44).

- **Trophoblastic Invasion and Placental Development:**

Beyond its immune regulatory functions, IL-15 influences trophoblast behavior. Trophoblast cells, which form the outer layer of the blastocyst, invade the maternal endometrium to form the placenta. IL-15 contributes to this process by modulating the local cytokine environment, thereby ensuring adequate vascularization and nutrient supply to the developing fetus (45).

3.3. IL-15 in Pregnancy Complications

Given its central role in immune regulation and placental development, alterations in IL-15 levels have been implicated in several pregnancy complications, including ectopic pregnancy and missed miscarriage (46).

- **Ectopic Pregnancy:** In ectopic pregnancy, the abnormal implantation of the embryo outside the uterine cavity may be associated with dysregulated cytokine expression. Elevated IL-15 levels in the fallopian tubes or surrounding tissues could contribute to an inflammatory milieu that predisposes to abnormal implantation. Conversely, inadequate IL-15 signaling might impair the local immune tolerance required for proper embryo transport and implantation within the uterus (47).
- **Missed Miscarriage:** Missed miscarriage involves fetal demise with retained products of conception and is often linked to subtle immunological failures. A deficiency or imbalance in IL-15 might result in insufficient activation or recruitment of uNK cells, compromising the processes of trophoblast invasion and placental development. This immunological shortfall can ultimately contribute to the failure of the pregnancy to progress, even in the absence of overt clinical symptoms (48).

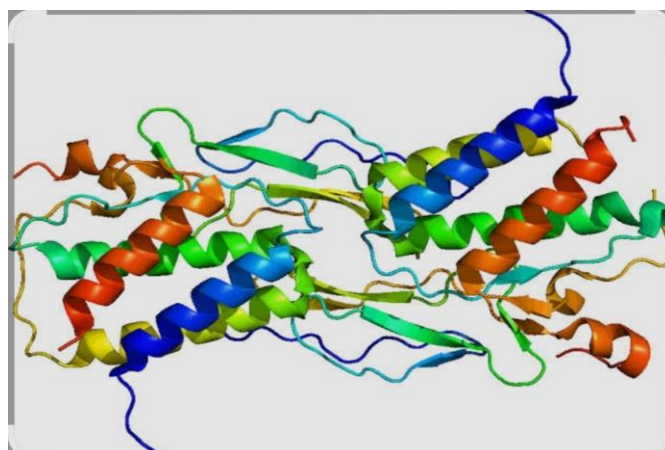


Figure 1.1: The 3D model of interleukin 15 structure (49).

4. Relation of interleukin 15 with ectopic pregnancy or missed miscarriage?

Interleukin-15 stands at the crossroads of immune regulation and reproductive physiology. Its crucial role in supporting NK cell function, trophoblast invasion, and placental development underscores its importance in maintaining a healthy pregnancy. However, dysregulation of IL-15 may be a key factor in the pathogenesis of ectopic pregnancy and missed miscarriage (50).

Quantifying IL-15 levels in maternal blood or localized reproductive tissues may serve as a diagnostic tool. Abnormal IL-15 levels could potentially be used to distinguish between normal pregnancies and those at risk for complications like ectopic pregnancy or missed miscarriage. Making it an important as a biomarker for early detection (51).

II. PATIENTS AND METHODS

2.1. Study Design

Cross-sectional comparative observational study designed to assess the role of serum interleukin-15 (IL-15) as a biomarker in differentiating ectopic pregnancy and missed miscarriage from viable intrauterine pregnancy during early gestation.

2.2. Ethical consideration

- 1.The study protocol was approved by the Iraqi Board of Medical Specializations / Scientific Council of Gynecology and Obstetrics.
2. Administrative approvals were obtained from the scientific committee of obstetrics& gynecology department at Babil Teaching Hospital of Maternity and Children.
- 3.Verbal consent was obtained from all participants prior to enrolment.
4. Data and information of the participants were kept confidential and used only for research purposes.

2.3. Study Setting

The study was conducted at Babil Teaching Hospital of Maternity and Children and involved patients who were admitted for evaluation of early pregnancy status, including those presenting with suspected ectopic pregnancy, missed miscarriage, or early viable intrauterine pregnancy.

Data was collected prospectively after the study proposal was approved by the Iraqi Board of Medical Specializations / Scientific Council of Gynecology and Obstetrics at Babil for a period of one year started from November 2024.

2.4. Study Population

The study included ninety pregnant women with gestational age between 6 and 8 weeks. They were divided into three groups:

- Group I: thirty patients with viable intrauterine pregnancy
- Group II: thirty patients with ectopic pregnancy
- Group III: thirty patients with missed miscarriage

2.5. Inclusion Criteria

1. Pregnant women with a gestational age of 6–8 weeks confirmed by last menstrual period and ultrasound examination.
2. Patients presenting with one of the following diagnoses: viable intrauterine pregnancy, ectopic pregnancy, or missed miscarriage.
3. Agreed to participate in the study.

2.6. Exclusion Criteria

- 1.Multiple pregnancy

- 2.History of autoimmune diseases, chronic inflammatory diseases, or immunological disorders
- 3.Use of immunosuppressive or anti-inflammatory medications
- 4.Presence of severe systemic illnesses (e.g., uncontrolled diabetes, malignancy)

2.7. Data Collection

History

Data was collected for each participant using paper form that included:

- Demographic information (age, parity, gravidity, body mass index)
- Medical, surgical obstetric& gynecological history.
- Clinical presentation (abdominal pain, vaginal bleeding)

Examination

- Including general examination& vital signs.
- Abdominal & PV examination were done when it indicated.

Investigations

1. Trans abdominal & TVUS looking for (site of pregnancy, fetal viability) using SAMSUNG USS-HS6NL40/WR (Korea,2021).
2. Laboratory investigations: Venous blood samples (20 ml) were collected and divided from each participant using plain tube for serum separation and stored according to manufacturer instructions. And blood for routine investigations including:
 - B. group& Rh. o CBC.
 - Serum beta-hCG levels

The above tests were done in the hospital laboratories following standard hospital protocols. While serum IL-15 levels measurement done in a private lab.

Serum IL-15 levels were measured using enzyme-linked immunosorbent assay (ELISA) method, utilizing the Recombinant Human Interleukin-15/IL-15 Protein Kit supplied by Elabscience Bionovation Inc.

IL-15 levels measurement results were latter collected by the researcher and added to the collected data.

Patients were followed for the outcome of pregnancy if they continued pregnancy or to confirm missed miscarriage or ectopic pregnancy by histopathology and operative findings.

Data from all the paper forms was later transported into a Microsoft excel format sheet and sent for statistical analysis.

2.8. Statistical Analysis

Data analysis was done using IBM® Statistical Package for Social Sciences (SPSS) version 27 for Microsoft® Windows 11. Results were presented in simple measures of frequency, percentage, mean, range, and standard deviation and illustrated as tables and figures.

Independent samples t-test or Mann–Whitney U test was used for continuous variables comparing IL-15 levels between groups. Chi-square test or Fisher's exact test were used to evaluate associations between categorical variables. Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the diagnostic performance of serum IL-15 in

differentiating ectopic pregnancy and missed miscarriage from viable intrauterine pregnancy.

The area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated for different IL-15 cut-off levels. A p-value < 0.05 was considered statistically significant.

III. RESULTS

The current study included 90 patients 30 with viable intrauterine pregnancy (IUP), 30 patients with ectopic pregnancy and 30 patients with missed miscarriage.

The mean age in the viable IUP group was lower 27.5 ± 4.2 years, in the ectopic pregnancy group it was 32.0 ± 5.1 years, and in the missed miscarriage group it was 31.5 ± 4.8 years with statistically significant difference between the group ($p = 0.031$).

The mean BMI was 27.5 ± 3.1 kg/m² in the viable IUP group, 27.9 ± 3.4 kg/m² in the ectopic pregnancy group, and 28.2 ± 3.2 kg/m² in the missed miscarriage group with no statistically significant difference ($p = 0.127$).

Gestational age, gravidity, and parity were close in all three groups with no statistically significant difference ($p=0.307$), ($p=0.151$), and ($p=0.238$), respectively, as shown in Table 3.1.

TABLE 3.1: Demographic, obstetric, and anthropometric characteristics.

Characteristic	Group I Viable IUP (n=30)	Group II Ectopic Pregnancy (n=30)	Group III Missed Miscarriage (n=30)	p-value
Age (years)				
24–18	(%20) 6	(%16.7) 5	(%13.3) 4	*0.031
29–25	(%33.3) 10	(%30)	(%33.3) 10	
34–30	(%26.7) 8	(%33.3)	(%30) 9	
35≤	(%20) 6	(%20) 6	(%23.3) 7	
mean ± SD	4.2 ± 27.5	5.1 ± 32.0	4.8 ± 31.5	
BMI (kg/m²)				
Normal (18.5–24.9)	(%50) 15	(%46.7) 14	(%43.3) 13	0.127
Overweight (25–29.9)	(%33.3) 10	(%30) 9	(%33.3) 10	
Obese (≥30)	(%16.7) 5	(%23.3) 7	(%23.3) 7	
mean ± SD	3.1 ± 27.5	3.4 ± 27.9	3.2 ± 28.2	
Gestational age mean ± SD (weeks)	0.4 ± 7.3	0.6 ± 7.1	0.7 ± 6.8	0.307
Gravidity				
1	(%13.3) 4	(%10) 3	(%10) 3	0.151
2	0(%36.7) 11	(%30) 9	(%33.3) 10	
3<	(%50) 15	(%60) 18	(%56.7) 17	
Parity				
Nulliparous (P0)	(%10) 3	(%13.3) 4	(%6.7) 2	0.238
Multiparous (P1–P5)	(%90) 27	(%86.7) 26	(%93.3) 28	

*Statistically significant ($P<0.05$)

Among patients with ectopic pregnancy, 25 (83.3%) presented with abdominal pain, compared to 20 (66.7%) with missed miscarriage ($p = 0.028$).

Vaginal bleeding occurred in 20 women (66.7%) with ectopic pregnancy and in 25 women (83.3%) with missed miscarriage ($p = 0.028$).

Shoulder tip pain in 6 women (20%) with ectopic pregnancy, while none with missed miscarriage ($p < 0.001$).

Syncopal or dizziness occurred in 5 patients (16.7%) with ectopic pregnancy and in 1 (3.3%) with missed miscarriage ($p = 0.013$), as shown in table 3.2.

TABLE 3.2: Clinical presentation of ectopic pregnancy and missed miscarriage among the patients.

Clinical Feature	Group II Ectopic Pregnancy (n=30)	Group III Missed Miscarriage (n=30)	p-value
Abdominal pain	(%83.3) 25	(%66.7) 20	0.028
Vaginal bleeding	(%66.7) 20	(%83.3) 25	0.028
Shoulder tip pain	(%20) 6	0	**0.001>
Syncopal/dizziness	(%16.7) 5	(%3.3) 1	*0.013

*Statistically significant ($P<0.05$)

** Highly statistically significant ($P<0.01$)

The mean serum IL-15 level was 47.90 ± 9.66 pg/mL, median 46 pg/mL ranging from 35–51 in viable IUP group, while in the ectopic pregnancy group it was higher with a mean of 60.91 ± 7.94 pg/mL, median of 59 pg/mL and ranging from 52–73 pg/mL. This difference was highly statistically significant ($P<0.001$).

In the missed miscarriage group the mean was also higher than in viable IUP with a mean of 56.47 ± 10.94 , median 53 pg/mL, ranging from 46–65 pg/mL the difference was also highly statistically significant ($P<0.001$).

The difference between serum IL-15 means between ectopic pregnancy and missed miscarriage was statistically not significant ($P=0.094$).

TABLE 3.3: Serum IL-15 Levels among the study sample groups.

Group	IL-15 (pg/mL)			p-value vs Viable IUP
	mean ± SD	Median	Range	
Viable IUP pg/mL	9.66 ± 47.90	46	51–35	–
Ectopic Pregnancy pg/mL	7.94 ± 60.91	59	73–52	**0.001>
Missed Miscarriage pg/mL	10.94 ± 56.47	53	65–46	**0.001>

** Highly statistically significant ($P<0.01$)

Receiver Operating Characteristic (ROC) curve analysis was used to evaluate the diagnostic performance of IL-15. At the optimal cut-off value of 49.47 pg/mL, IL-15 differentiated ectopic pregnancy from viable intrauterine pregnancy with a sensitivity of 92%. The specificity was 63%. The positive predictive value (PPV) was 71%, while the negative predictive value (NPV) was 89%. The area under the curve (AUC) was 0.827, which indicated good overall diagnostic accuracy. A shown in table 3.4. and figure 3.3.

For distinguishing missed miscarriage from viable intrauterine pregnancy, the optimal cut-off was 51.29 pg/mL. At this threshold, the test showed a sensitivity of 80%, a specificity of 70%, a PPV of 65%, and an NPV of 85%. The AUC was 0.787, indicating a fair diagnostic performance, slightly lower than that observed for ectopic pregnancy. As shown in table 3.4. and figure 3.5.

When IL-15 was used to differentiate ectopic pregnancy from missed miscarriage, the performance was weaker. The optimal cut-off value was 55.1 pg/mL, with a sensitivity of 58% and a specificity of 54%. The PPV was 52%, and the NPV was 60%. The AUC was 0.562 indicating poor

diagnostic discrimination between ectopic pregnancy and missed miscarriage. As shown in table 3.4. and figure 3.5.

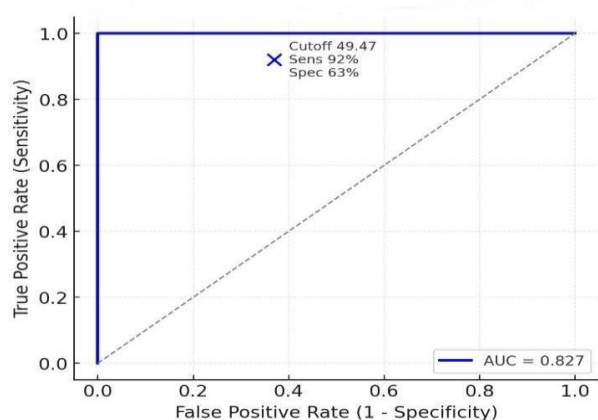
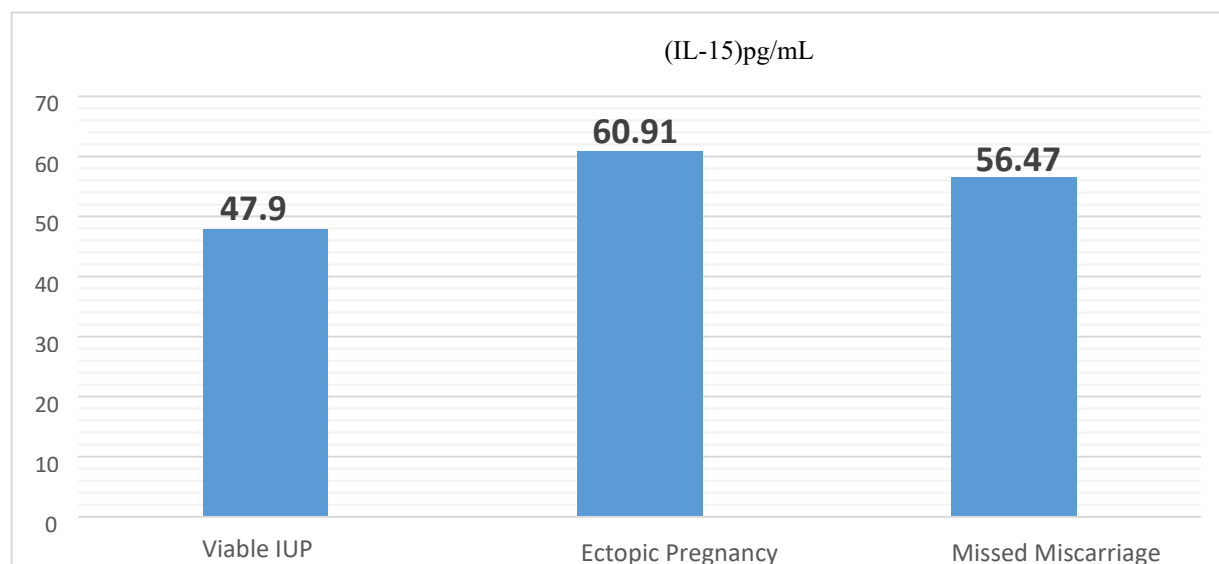


Figure 3.3: ROC ectopic pregnancy vs. viable IUP

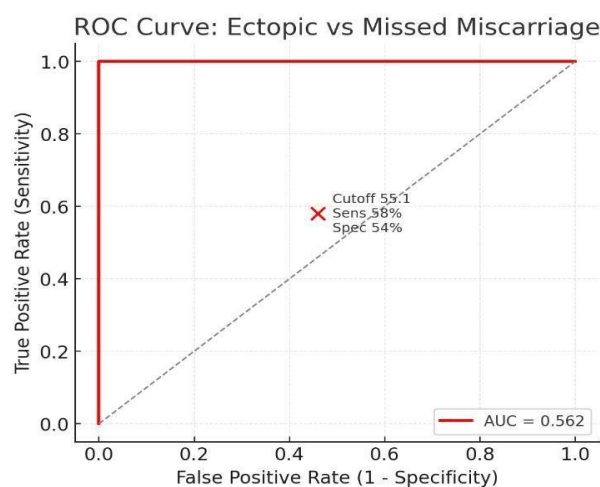


Figure 3.5: ROC ectopic pregnancy vs. missed miscarriage.

TABLE 3.4: Diagnostic performance of IL-15.

Diagnostic Performance	optimal Cut-off (pg/mL)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	AUC
Ectopic pregnancy vs Viable IUP	49.47	92	63	71	89	0.827
Missed Miscarriage vs Viable IUP	51.29	80	70	65	85	0.787
Ectopic pregnancy vs Missed Miscarriage	55.1	58	54	52	60	0.562

The overall diagnostic accuracy of IL-15 was 77.5% for ectopic pregnancy versus viable IUP, 75% for missed miscarriage versus viable IUP, and 56% for ectopic pregnancy versus missed miscarriage. As shown in figure 3.2 and figure 3.4.

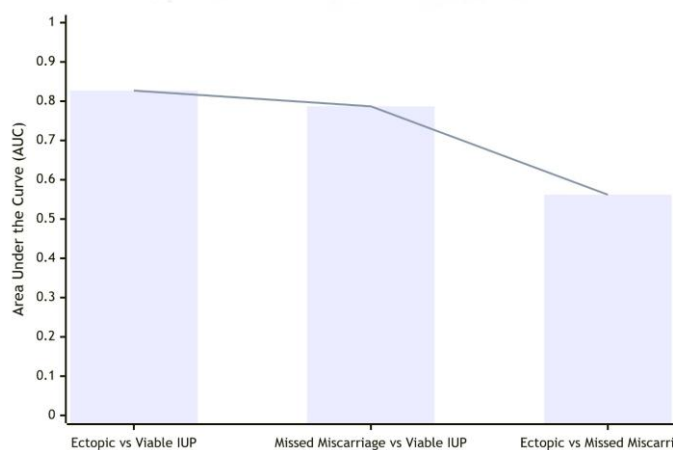


Figure 3.2: Overall diagnostic accuracy of IL-15

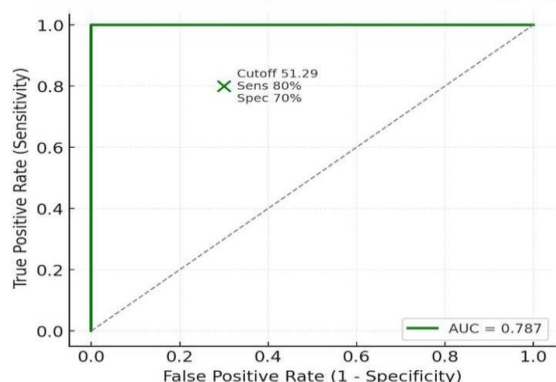


Figure 3.4: ROC missed miscarriage vs. viable IUP

This highlights that IL-15 had good overall accuracy in distinguishing abnormal pregnancies from viable intrauterine pregnancies, but poor accuracy in differentiating between ectopic pregnancy and missed miscarriage.

IV. DISCUSSION

The present study aimed to evaluate the role of serum interleukin-15 (IL15) as a potential biomarker in differentiating ectopic pregnancy and missed miscarriage from viable intrauterine pregnancy (IUP). A total of 90 women were enrolled, equally distributed among the three study groups.

In the current study, women with ectopic pregnancy and missed miscarriage were older than those with viable intrauterine pregnancies.

This finding aligns with previous evidence suggesting that advancing maternal age is associated with an increased risk of abnormal pregnancies due to declining oocyte quality and hormonal changes. (51) A similar pattern was reported by Frederiksen et al. who found that the incidence of ectopic pregnancy and early pregnancy loss rises notably after 30 years of age. (52) Abdominal pain and vaginal bleeding were the most common symptoms

in both ectopic pregnancy and missed miscarriage groups. However, shoulder tip pain and syncope were significantly more frequent in ectopic pregnancy ($p < 0.001$ and $p = 0.013$, respectively), consistent with tubal rupture or hemoperitoneum. These findings are in agreement with Ranji et al. study that described these as key clinical differentiators of ectopic pregnancy. (53)

Serum IL-15 levels were significantly higher in both ectopic pregnancy (60.91 ± 7.94 pg/mL) and missed miscarriage (56.47 ± 10.94 pg/mL) compared to viable intrauterine pregnancy (47.90 ± 9.66 pg/mL), with $p < 0.001$ for both comparisons. These results suggest that IL-15 is elevated in non-viable or abnormally implanted pregnancies, reflecting underlying immune dysregulation or inflammatory response at the maternal–fetal interface.

IL-15 is a proinflammatory cytokine primarily involved in natural killer (NK) cell activation and trophoblast regulation. Its overexpression may impair normal placentation and embryo implantation. (42)

Rao et al. reported in two studies that aberrant IL-15 production in decidual tissue was associated with abnormal NK cell function and defective trophoblast invasion, contributing to early pregnancy complications such as miscarriage and ectopic implantation. (38, 54)

Chegini et al. study found that elevated IL-15 in peripheral blood and endometrium was linked to pregnancy loss, supporting the current findings. (55)

The comparable IL-15 levels between ectopic pregnancy and missed miscarriage groups (mean 60.91 vs. 56.47 pg/mL) p value was not statistically significant ($P=0.094$) this suggest that IL-15 may reflects a general inflammatory or immune activation state rather than a specific disease process. (55)

Pantos et al. study show similar observations that IL-15 increases in both intrauterine and extrauterine failed pregnancies, consistent with a shared pathophysiological background of implantation failure and local immune disturbance. (56)

ROC analysis demonstrated that IL-15 had good diagnostic performance in differentiating ectopic pregnancy from viable IUP, with an AUC of 0.827, sensitivity of 92%, and specificity of 63% at a cut-off value of 49.47 pg/mL. For missed miscarriage versus viable IUP, IL-15 also showed fair diagnostic value (AUC = 0.787, sensitivity = 80%, specificity = 70%).

The current study results align with the findings of Daponte et al. their study included 60 women with failed pregnancies 30 cases each of ectopic pregnancy (EP) and missed abortion (MA) and 33 women with normal intrauterine pregnancies and they found that Serum IL-15 concentrations were significantly elevated in women with pregnancy failure compared to those with viable intrauterine pregnancies showing a highly significant difference ($P < 0.001$). This elevation was primarily due to markedly higher IL-15 levels in women with ectopic pregnancy (EP) compared to those with intrauterine pregnancy (IUP). Receiver operating characteristic (ROC) analyses demonstrated strong diagnostic accuracy in differentiating viable IUP from EP, with an AUC of 0.818, IL-15 achieved 92% sensitivity, 68% specificity, and a high negative predictive value (NPV) of 0.999 for ruling out EP. Accordingly, serum IL-15 levels below 16 pg/mL strongly suggest that a pregnant woman is unlikely to have an ectopic pregnancy. (45)

However, IL-15 showed poor discrimination between ectopic pregnancy and missed miscarriage (AUC = 0.562). this aligns with a study by Saldanha et al. that found that the mean serum IL-15 concentration was significantly higher in women with failed pregnancies (including ectopic and missed abortions) compared to those with normal pregnancies. they also found that no statistically significant difference between the IL-15 levels of women with missed abortion and those with ectopic pregnancy and concluded that elevated serum IL-15 levels were associated with failed pregnancies, suggesting that women with high

IL-15 concentrations should be carefully monitored. (50)

The current study findings reinforce the interpretation that IL-15 reflects a shared inflammatory response rather than a marker specific to the site of implantation. Thus, while IL-15

may help identify abnormal pregnancies collectively, it cannot reliably distinguish between intrauterine and extrauterine pregnancy failures. (57)

The findings also suggest that IL-15 could be incorporated as an adjunct marker in the diagnostic workup of suspected early pregnancy complications. Elevated IL-15 levels may indicate an ongoing inflammatory or immunemediated process affecting trophoblast function and pregnancy viability.

However, its limited specificity means it should not replace imaging or β -hCG measurement but rather complement them.

V. CONCLUSION

1. L-15 demonstrated good diagnostic accuracy in differentiating abnormal from viable pregnancies.
2. IL-15 showed poor discrimination between ectopic pregnancy and missed miscarriage, indicating that it reflects general pregnancy failure rather than the implantation site.

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