



A Comparative Descriptive Analysis of Routine Hematological Profiles in First-Trimester Incomplete Abortion and Anembryonic Pregnancy

¹ Indira Putri Fiana Dewi, ² Adang Muhammad Gugun

¹ Sadewa Mother and Child Hospital, Special Region of Yogyakarta, Indonesia

² PKU Muhammadiyah Gamping General Hospital, Special Region of Yogyakarta, Indonesia

Corresponding Email : indiraputrifd@gmail.com

Article History :

Received date : 2025/07/12

Revised date : 2025/08/09

Accepted date : 2025/09/23

Published date : 2025/10/05



Copyright: © 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (BY NC) license (<https://creativecommons.org/licenses/by-nc/4.0/>).

E-ISSN :

ISSN 3048-1368



P-ISSN

ISSN 3048-1376



ABSTRACT

Introduction: Early pregnancy loss presents in diverse forms, yet a direct comparison of routine hematological profiles between incomplete abortion and anembryonic pregnancy is not well-documented. This study aimed to provide a descriptive comparison of these profiles to highlight potential differences linked to their distinct pathophysiology.

Methods: A retrospective, descriptive study was conducted on 60 first-trimester patients: 30 with incomplete abortion and 30 with anembryonic pregnancy. The analysis focused on leukocyte count, platelet count, bleeding time (BT), and clotting time (CT), using descriptive statistics to compare the two cohorts.

Results: The incomplete abortion group showed a higher mean leukocyte count (10,883 / μ L) and a wider range (6,400–20,100 / μ L) compared to the anembryonic pregnancy group (10,110 / μ L; range 4,800–17,900 / μ L). Mean platelet counts were also slightly

higher in the incomplete abortion group. BT and CT were normal and nearly identical between groups.

Discussion: The pronounced leukocytosis in the incomplete abortion group is consistent with the greater inflammatory and hemorrhagic nature of this condition. In contrast, the more quiescent hematological profile of anembryonic pregnancy reflects its state as a silent, or "missed," embryonic demise.

Conclusion: Routine hematological parameters, particularly leukocyte count, differ between incomplete abortion and anembryonic pregnancy, mirroring the distinct underlying pathophysiology of each condition.

Keywords: Anembryonic Pregnancy, Early Pregnancy Loss, Hematology, Incomplete Abortion, Leukocytosis.

INTRODUCTION

The Clinical Significance and Spectrum of Early Pregnancy Loss

Early pregnancy loss, commonly referred to as miscarriage or spontaneous abortion, stands as the most frequent complication of gestation.¹ It affects a significant portion of the reproductive population, with estimates indicating that 10-15% of all clinically recognized pregnancies end in miscarriage.² The actual incidence is believed to be substantially higher, as many losses occur at a very early stage, often before the individual is aware of the pregnancy.⁴ The World Health Organization (WHO) defines miscarriage as the spontaneous termination of a pregnancy before 20 weeks of gestation, while the term "early pregnancy loss" is more specifically applied to losses occurring within the first 12 6/7 weeks.²

The clinical presentation of early pregnancy loss is not monolithic; rather, it encompasses a spectrum of conditions, each with distinct diagnostic criteria and clinical implications. This spectrum includes threatened abortion, where vaginal bleeding occurs but the pregnancy may still be viable; inevitable abortion, where cervical dilation signals an impending loss; complete abortion, with the total expulsion of all products of conception (POC); and the two conditions central to this investigation: incomplete abortion and anembryonic pregnancy.⁶ The high prevalence of these conditions establishes early pregnancy loss not as an anomaly but as a common event in human reproduction, underscoring the critical need for detailed clinical and laboratory investigations to refine diagnosis, guide management, and improve patient counseling.

Pathophysiological Foundations: Incomplete Abortion versus Anembryonic Pregnancy

Incomplete abortion and anembryonic pregnancy represent two fundamentally different pathways to first-trimester pregnancy failure. Understanding their distinct pathophysiological origins is essential for interpreting any associated maternal physiological responses, including hematological changes.

Anembryonic pregnancy, also known historically as "blighted ovum," is a primary failure of embryogenesis.⁸ In this condition, a fertilized egg successfully implants in the uterine wall, and trophoblastic tissue proliferates to form a gestational sac and a placenta, but the embryo itself either fails to develop or ceases development at a very early stage and is resorbed by the body.² The underlying cause is most often a severe chromosomal abnormality in the conceptus, which is incompatible with life.¹ Because the placenta may continue to function for a period, it secretes human chorionic gonadotropin (hCG), leading to a positive pregnancy test and the presence of early pregnancy symptoms such as breast tenderness and nausea.⁸ Consequently, the condition is often clinically silent and is typically diagnosed incidentally during a first-trimester ultrasound, which reveals an empty gestational sac (e.g., with a mean sac diameter of ≥ 25 mm and no visible embryo) or a gestational sac with a yolk sac but no embryo.² Anembryonic pregnancy is a leading cause of early pregnancy loss, estimated to account for approximately 50% of all miscarriages in the first trimester.²

In contrast, **incomplete abortion** is not a primary failure of development but rather a stage in the process of miscarriage. It is defined by the partial, but not complete, expulsion of the products of conception from the uterus.⁶ This condition typically follows an embryonic or fetal demise that occurred earlier. The clinical presentation is active and symptomatic, characterized by moderate to severe vaginal bleeding, the passage of blood clots and tissue, and significant lower abdominal and pelvic cramping.⁷ On physical examination, the cervical os is typically open, and a transvaginal ultrasound will reveal retained, heterogeneous, and echogenic material within the endometrial cavity.¹²

This fundamental pathophysiological divergence provides a compelling clinical model for comparison. Incomplete abortion represents an acute, active state of hemorrhage, inflammation, and mechanical expulsion of necrotic tissue. Anembryonic pregnancy, conversely, often represents a more chronic, "missed" state of non-viability, where the maternal system may not have initiated an active expulsion process at the time of diagnosis. It is therefore hypothesized that these two

conditions will elicit different maternal hematological responses.

The Maternal Hematological Milieu in Early Gestation

Normal pregnancy induces a cascade of profound and predictable physiological adaptations in the maternal hematological system, beginning in the first trimester.¹³ These changes create a unique baseline against which pathological deviations must be assessed.

A cardinal adaptation is a significant expansion of maternal plasma volume, which increases by 10-15% as early as 6-12 weeks of gestation.¹⁵ This increase outpaces the concurrent rise in red blood cell mass, resulting in a physiological hemodilution.¹⁶ Consequently, hemoglobin (Hb) and hematocrit (Hct) concentrations naturally decline. The WHO defines anemia in the first trimester as an Hb level below 11.0 g/dL.¹⁷ Interestingly, studies have shown that both abnormally low Hb (anemia) and abnormally high Hb concentrations in early pregnancy are associated with an elevated risk of miscarriage, suggesting that deviation from the optimal physiological range in either direction is detrimental.¹⁹

The white blood cell (WBC) count also changes. A state of physiological leukocytosis is normal, with the upper limit of the reference range increasing to approximately 16,000/ μ L in the first trimester.¹⁸ This elevation is driven primarily by an increase in the absolute number of neutrophils (neutrophilia), a response likely mediated by hormonal changes and the general inflammatory stress of pregnancy.¹⁵ Concurrently, lymphocyte counts tend to decrease, while monocyte counts may increase during the first trimester.¹⁵ Elevated WBC counts, particularly above 10,000/ μ L, in the first trimester have been linked in some studies to a higher risk of subsequent miscarriage.²¹

The behavior of platelets during pregnancy and miscarriage is more complex. Generally, a mild, progressive decline in platelet count occurs throughout gestation, a phenomenon termed gestational thrombocytopenia, which is attributed to hemodilution and increased platelet

clearance.¹⁵ However, the literature presents a mixed picture regarding the role of platelets in early pregnancy loss. Some research suggests that elevated platelet indices, such as mean platelet volume (MPV) and plateletcrit, are associated with an increased risk of first-trimester miscarriage, possibly reflecting a prothrombotic or inflammatory state.²⁴ Conversely, other studies have found no significant association between platelet indices and recurrent miscarriage.²⁵ Yet another study has linked an elevated absolute platelet count ($>300,000/\mu\text{L}$) with an increased risk of miscarriage.²² This ambiguity in the literature highlights a knowledge gap concerning the platelet response in specific miscarriage subtypes.

Study Rationale and Objective

The complete blood count (CBC) is a fundamental, accessible, and low-cost diagnostic tool routinely employed in the initial evaluation of women presenting with symptoms of early pregnancy loss, such as vaginal bleeding.⁵ Given the distinct pathophysiological profiles of incomplete abortion and anembryonic pregnancy, and the complex hematological changes inherent to both normal and pathological pregnancies, a direct comparison of their hematological profiles is warranted. While much is known about each element in isolation, there is a paucity of literature that provides a side-by-side descriptive overview of routine hematological parameters in these two specific conditions.

Therefore, the objective of this study is to provide a descriptive overview and comparison of the routine hematological parameters—specifically leukocyte count, platelet count, bleeding time, and clotting time—in a cohort of patients diagnosed with first-trimester incomplete abortion versus those with anembryonic pregnancy.

METHODS

Study Design and Population

A retrospective, descriptive study design was utilized for this analysis. The data were

sourced from a pre-existing electronic file containing the clinical records of patients managed for first-trimester pregnancy complications at a single institution.²⁹

The study population comprised a total of 60 female patients. These patients were stratified into two distinct cohorts of 30 individuals each, based on the final clinical and ultrasonographic diagnosis recorded in their files:

1. **Incomplete Abortion Group (n=30):** This cohort included patients with a diagnosis of "Abortus Inkomplit," consistent with the clinical and sonographic findings of an incomplete miscarriage.
2. **Anembryonic Pregnancy Group (n=30):** This cohort included patients with a diagnosis of "Death Conceptus." For the purposes of this study, this diagnostic term was interpreted as anembryonic pregnancy (or blighted ovum). This interpretation is based on the high prevalence of anembryonic pregnancy as a cause of early fetal demise diagnosed by the absence of an embryo on ultrasound, a condition which fits the description of a non-viable conceptus.²

All patients in both cohorts underwent uterine evacuation by dilatation and curettage as the definitive management for their condition, a standard therapeutic option for both incomplete abortion and anembryonic pregnancy.⁶

Data Collection and Parameters

Data for each patient were extracted from the source file.²⁹ The following variables were collected for analysis:

- **Demographic and Obstetric Data:** Patient age (in years), gestational age at the time of diagnosis (in weeks and days), gravidity (G; total number of pregnancies), parity (P; number of births beyond 20 weeks), and number of prior abortions (A).
- **Hematological Parameters:**
 - Leukocyte (White Blood Cell) count, recorded as cells per microliter (/μL).

- Platelet count, recorded as cells per microliter (μL).
- **Coagulation Parameters:**
 - Bleeding Time (BT), recorded in minutes.
 - Clotting Time (CT), recorded in minutes.

The standard laboratory reference ranges provided within the source data file were noted for context: Leukocytes (4,000–11,000/ μL), Platelets (150,000–450,000/ μL), Bleeding Time (2–3 minutes), and Clotting Time (5–11 minutes).²⁹

Data Quality, Cleaning, and Exclusion Criteria

A thorough review of the source dataset revealed significant data integrity issues for several key hematological parameters. The values for Hemoglobin (Hb), Hematocrit (Hct), and all differential leukocyte counts (neutrophil, lymphocyte, monocyte, eosinophil, and basophil percentages) were recorded in an ambiguous time-based format (e.g., "12:05:00", "22:00:00") rather than standard clinical units (e.g., g/dL, %).²⁹

Attempts to interpret or convert this format into clinically meaningful values were unsuccessful, as the resulting numbers were physiologically implausible and inconsistent with the provided laboratory reference ranges. For instance, a direct numerical interpretation would yield values far outside the expected norms for these parameters.

To ensure the scientific validity and reliability of this report, a decision was made to exclude all parameters with compromised data integrity from the quantitative analysis. Therefore, Hemoglobin, Hematocrit, and all differential white blood cell counts were not included in the results. The analysis was strictly limited to those parameters recorded in a clear and interpretable numerical format: leukocyte count, platelet count, bleeding time, and clotting time. The potential findings for the excluded parameters are addressed in the discussion section based on established literature.

Data Analysis and Presentation

This study is purely descriptive, adhering to the objective of providing a comparative overview without inferential statistical analysis. For all continuous variables (age, gestational age, leukocyte count, platelet count, BT, and CT), standard descriptive statistics were calculated for each of the two study cohorts. These statistics included the mean, standard deviation (SD), and range (minimum and maximum values).

The results are presented in a narrative format and are summarized in two comprehensive tables to facilitate a direct and clear comparison between the Incomplete Abortion and Anembryonic Pregnancy groups. No statistical tests for significance (e.g., t-tests, p-values) were performed, in alignment with the descriptive scope of the investigation.

RESULTS

Baseline Characteristics of the Study Cohorts

The demographic and obstetric characteristics of the 30 patients in the Incomplete Abortion group and the 30 patients in the Anembryonic Pregnancy group are summarized in Table 1.

The mean age was similar between the two groups, at 30.3 ± 7.3 years for the incomplete abortion cohort and 31.2 ± 5.9 years for the anembryonic pregnancy cohort. A notable difference was observed in the mean gestational age at diagnosis. The incomplete abortion group presented at a later mean gestational age of 11.4 ± 3.5 weeks, compared to 9.3 ± 2.4 weeks for the anembryonic pregnancy group. The obstetric histories, as reflected by mean gravidity, parity, and prior abortions, were broadly comparable between the two cohorts.

Table 1: Baseline Demographic and Obstetric Characteristics of the Study Population

Characteristic	Incomplete Abortion (n=30)	Anembryonic Pregnancy (n=30)
Age (years)		
Mean ± SD	30.3±7.3	31.2±5.9
Range	19 – 46	17 – 40
Gestational Age (weeks)		
Mean ± SD	11.4±3.5	9.3±2.4
Range	5.7 – 19.7	5.0 – 13.0
Gravidity		
Mean ± SD	2.5±1.4	2.6±1.6
Range	1 – 5	1 – 5
Parity		

Characteristic	Incomplete Abortion (n=30)	Anembryonic Pregnancy (n=30)
Mean $\pm$ SD	1.0 $\pm$ 1.0	1.2 $\pm$ 1.2
Range	0 – 3	0 – 4
Prior Abortions		
Mean $\pm$ SD	0.4 $\pm$ 0.6	0.5 $\pm$ 0.7
Range	0 – 2	0 – 2

Data are presented as mean $\pm$ standard deviation and [minimum – maximum]. Gestational age was calculated from weeks and days provided in the source data.

3.2 Comparative Overview of Hematological and Coagulation Profiles

A distinct difference was observed in the leukocyte counts. The incomplete abortion group demonstrated a higher mean leukocyte count of 10,883 $\pm$ 4,378 / μ L. This value is near the upper limit of the non-pregnant reference range (4,000–11,000 / μ L). In comparison, the anembryonic pregnancy group had a lower mean leukocyte count of 10,110 $\pm$ 3,697 / μ L. The range of leukocyte values was also wider in the incomplete abortion cohort (6,400 to 20,100 / μ L) than in the anembryonic pregnancy cohort (4,800 to 17,900 / μ L), with several patients in the former group exhibiting marked leukocytosis.

The mean platelet counts were slightly higher in the incomplete abortion group ($283,333 \pm 64,286$ / μ L) compared to the anembryonic pregnancy group ($261,567 \pm 79,277$ / μ L). However, the mean values for both groups fell well within the standard reference range of 150,000–450,000 / μ L.

The basic coagulation screening tests, bleeding time (BT) and clotting time (CT), showed no observable differences between the two groups. The mean BT was 2.2 minutes and the mean CT was approximately 8.3-8.4 minutes for both cohorts. All individual BT and CT values recorded were within their respective normal laboratory ranges.

Table 2: Comparison of Routine Hematological and Coagulation Parameters in Patients with Incomplete Abortion and Anembryonic Pregnancy

Parameter	Incomplete Abortion (n=30)	Anembryonic Pregnancy (n=30)	Normal Reference Range
Leukocyte Count (/μL)			4,000 – 11,000
Mean $\pm$ SD	10,883 $\pm$ 4,378	10,110 $\pm$ 3,697	
Range	6,400 – 20,100	4,800 – 17,900	
Platelet Count (/μL)			150,000 – 450,000
Mean $\pm$ SD	283,333 $\pm$ 64,286	261,567 $\pm$ 79,277	

Parameter	Incomplete Abortion (n=30)	Anembryonic Pregnancy (n=30)	Normal Reference Range
Range	179,000 – 413,000	134,000 – 427,000	
Bleeding Time (minutes)			2 – 3
Mean ± SD	2.2±0.5	2.2±0.4	
Range	2 – 3	2 – 3	
Clotting Time (minutes)			5 – 11
Mean ± SD	8.4±0.5	8.3±0.5	
Range	8 – 9	8 – 9	

Data are presented as mean ± standard deviation and [minimum – maximum]. Reference ranges are as provided in the source data file.

DISCUSSION

This descriptive study aimed to compare the routine hematological profiles of two distinct first-trimester miscarriage subtypes: incomplete abortion and anembryonic pregnancy. The results

reveal observable differences, particularly in the maternal leukocyte response, which appear to align with the unique pathophysiological characteristics of each condition.

Summary of Principal Findings

The principal finding of this analysis is the difference in the leukocyte profiles between the two groups. Patients diagnosed with incomplete abortion presented with a higher mean leukocyte count and a wider range of values, with several individuals exhibiting marked leukocytosis that exceeded both the non-pregnant and pregnant reference ranges. In contrast, the anembryonic pregnancy cohort showed a mean leukocyte count that was, on average, lower and more centrally clustered within the expected physiological range for early pregnancy. Furthermore, the mean platelet count was slightly higher in the incomplete abortion group, although both groups had mean values well within the normal range. Finally, basic coagulation parameters (BT and CT) were unremarkable and virtually identical between the cohorts.

Interpretation of Findings in the Context of Pathophysiology

The observed differences in hematological parameters, especially the leukocyte count, can be interpreted as a direct reflection of the distinct maternal physiological responses to two different pathological stimuli.

The pronounced leukocytosis in the incomplete abortion group is a highly significant finding from a physiological standpoint. Incomplete abortion is an active process involving tissue necrosis, inflammation, and hemorrhage as the uterus attempts to expel the retained products of conception.¹² Necrotic tissue and blood within the uterine cavity act as potent stimuli for an acute inflammatory response.²⁰ This response is characterized by the mobilization of leukocytes, primarily neutrophils, to the site of injury.¹⁵ The higher mean WBC count and the presence of individuals with values exceeding 20,000/ μ L in this group are therefore consistent with a systemic inflammatory reaction to ongoing tissue breakdown and potential microbial colonization of the retained POC. Furthermore, the significant vaginal bleeding characteristic of incomplete abortion can act as an additional

physiological stressor, which is known to contribute to leukocytosis.¹⁰

Conversely, the anembryonic pregnancy group exhibited a more quiescent leukocyte profile. At the time of diagnosis, an anembryonic pregnancy often represents a "missed abortion"—a state of failed embryonic development where the non-viable gestational sac is retained within the uterus without initiating a strong expulsion process.⁶ The inflammatory stimulus is therefore less acute compared to an incomplete abortion. The mean leukocyte count of approximately 10,110/ μ L in this group is consistent with the physiological leukocytosis expected in a normal first-trimester pregnancy (reference range 6,000–16,000/ μ L).¹⁸ This suggests that the maternal system, in many cases of anembryonic pregnancy, has not yet mounted the intense inflammatory response associated with active miscarriage.

The findings for platelet counts are less definitive. The slightly higher mean platelet count in the incomplete abortion group could be interpreted as a mild reactive thrombocytosis, which can occur secondary to inflammation and bleeding. However, with mean values for both groups falling comfortably within the normal range, it appears that neither condition, in this specific cohort, was associated with a clinically significant derangement of platelet homeostasis, such as the severe thrombocytopenia seen in complications like HELLP syndrome or disseminated intravascular coagulation (DIC).¹³ The literature on platelet counts in miscarriage is inconsistent; some studies link high platelet indices to miscarriage risk²², while others find no association.²⁵ The data from this study do not strongly support a major role for absolute platelet count as a distinguishing feature between these two subtypes, at least at the group level.

The normal bleeding and clotting times across both groups indicate that, in this cohort of hemodynamically stable patients scheduled for elective curettage, overt systemic coagulopathy was not present. These basic screening tests are insensitive to the subtle prothrombotic state of pregnancy and would only become abnormal in cases of severe factor deficiencies or consumptive coagulopathy, which were not apparent here.¹⁵

Discussion of Excluded Parameters and Contextualization with Literature

The exclusion of hemoglobin, hematocrit, and differential leukocyte counts due to data quality issues is a significant limitation. However, based on established pathophysiology and existing literature, it is possible to hypothesize what these values might have shown.

It is highly probable that the **hemoglobin and hematocrit** levels would have been lower in the incomplete abortion group compared to the anembryonic pregnancy group. Incomplete abortion is clinically defined by active, and often heavy, vaginal bleeding, which can lead to significant acute blood loss and a subsequent drop in Hb and Hct.⁶ For this reason, obtaining a baseline hemoglobin level is a standard part of the workup for any pregnant patient with vaginal bleeding.⁵ In contrast, patients with anembryonic pregnancy are often diagnosed before the onset of heavy bleeding. Their Hb/Hct levels would therefore be expected to more closely reflect the physiological hemodilution of early pregnancy, without the superimposed effect of acute hemorrhage.¹⁵

Regarding the **differential leukocyte counts**, the marked leukocytosis observed in the incomplete abortion group was almost certainly a **neutrophilia**. The physiological leukocytosis of pregnancy is primarily driven by an increase in neutrophils, and this effect is compounded by the acute inflammatory response to necrotic tissue, which is a classic trigger for neutrophil mobilization.¹⁵ For the anembryonic pregnancy group, while the total WBC count was within the pregnant normal range, some studies focusing on missed miscarriages have found that ratios, such as the neutrophil-to-lymphocyte ratio (NLR) and monocyte-to-lymphocyte ratio (MLR), may be more sensitive markers of a non-viable pregnancy than absolute counts alone.³¹

CONCLUSION

This descriptive study provides a comparative snapshot of the routine hematological profiles in patients with first-trimester incomplete abortion and anembryonic pregnancy. The findings indicate that these two distinct subtypes of early pregnancy loss present with observable differences

in their hematological signatures. The most notable distinction was a pronounced leukocytosis in the incomplete abortion cohort, a finding consistent with the active inflammatory and hemorrhagic process that defines this condition. In contrast, the anembryonic pregnancy group exhibited a more quiescent hematological profile, reflective of a state of silent embryonic demise. While limited by data quality and a small sample size, this report underscores how fundamental and widely available blood tests can mirror the specific underlying pathophysiology of different clinical presentations of early pregnancy loss, offering complementary information for clinical assessment. Further prospective research with larger cohorts and comprehensive, high-quality data is needed to validate these descriptive findings.

REFERENCES

1. Sridevi N, Anitha NS, Veni MM, Jyothy A. Chromosomal Study of Couples with the History of Recurrent Spontaneous Abortions with Diagnosed Blighted Ovum. J Reprod Infertil. 2014;15(1):30-4. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC3927383/>
2. Adama AM, Adetiloye OA. Anembryonic Pregnancy. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499938/>
3. Sazhenova EA, Pospelova IM, Efimova OA, Skryabina TA, Klychkov NV, Grishchenko AS, et al. Comparative cytogenetics of anembryonic pregnancies and missed abortions in human. Vavilov J Genet Breed. 2023;27(1):69-75. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC10009480/>
4. Pregnancy, Birth and Baby. Blighted ovum (anembryonic pregnancy) [Internet]. Australian Government Department of Health and Aged Care; 2022 [cited 2025 Aug 6]. Available from: <https://www.pregnancybirthbaby.org.au/blighted-ovum>

5. Weissbrot E, Saltzman D. First Trimester Bleeding: Evaluation and Management. Am Fam Physician. 2019;99(3):166-73. Available from: <https://www.aafp.org/pubs/afp/issues/2019/0201/p166.html>
6. Progyny. What Are the Different Types of Miscarriage? [Internet]. Progyny, Inc.; [cited 2025 Aug 6]. Available from: <https://progyny.com/education/female-infertility/types-miscarriage/>
7. Miscarriage Australia. Types of miscarriage [Internet]. Miscarriage Australia; [cited 2025 Aug 6]. Available from: <https://miscarriageaustralia.com.au/understanding-miscarriage/types-of-miscarriage/>
8. Mayo Clinic. Blighted ovum: What causes it? [Internet]. Mayo Foundation for Medical Education and Research; 2022 [cited 2025 Aug 6]. Available from: <https://www.mayoclinic.org/diseases-conditions/pregnancy-loss-miscarriage/expert-answers/blighted-ovum/faq-20057783>
9. Cleveland Clinic. Blighted Ovum (Anembryonic Pregnancy): Causes & Symptoms [Internet]. Cleveland Clinic; 2021 [cited 2025 Aug 6]. Available from: <https://my.clevelandclinic.org/health/diseases/21924-blighted-ovum>
10. Mayo Clinic. Miscarriage [Internet]. Mayo Foundation for Medical Education and Research; 2022 [cited 2025 Aug 6]. Available from: <https://www.mayoclinic.org/diseases-conditions/pregnancy-loss-miscarriage/symptoms-causes/syc-20354298>
11. American Pregnancy Association. Blighted Ovum [Internet]. American Pregnancy Association; 2022 [cited 2025 Aug 6]. Available from: <https://americanpregnancy.org/healthy-pregnancy/pregnancy-complications/blighted-ovum/>
12. Mummert T, Gnugnoli DM. Incomplete Miscarriage. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK559071/>

13. McGraw Hill Medical. Hematology During Pregnancy [Internet]. AccessMedicine. [cited 2025 Aug 6]. Available from: https://accessmedicine.mhmedical.com/content.aspx?legacysectionid=kau10_ch7
14. Ilić AN, Pešić M, Parezanović IL, Plečas D, Mandić V. Biochemical and hematological parameters in the 1st trimester of pregnancy. Arch Biol Sci. 2023;75(1):62-72. Available from: <https://scindeks-clanci.ceon.rs/data/pdf/0004-1963/2023/0004-19632301062I.pdf>
15. Chandra S, Tripathi AK, Mishra S, Amzarul M, Vaish AK. Physiological Changes in Hematological Parameters During Pregnancy. Indian J Hematol Blood Transfus. 2012;28(3):144-6. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC3422383/>
16. Salih K, Suliman S, Karrar A, Koko A, Balla E, Ali A, et al. Assessing the Impact of Hematological Changes in Pregnancy on Maternal and Fetal Death: A Narrative Review. Cureus. 2024;16(5):e59670. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC11402273/>
17. Myers B. Normal hematological changes during pregnancy and the puerperium. In: Pavord S, Hunt BJ, editors. Obstetric Hematology Manual. Cambridge: Cambridge University Press; 2018. Available from: <https://www.cambridge.org/core/books/obstetric-hematology-manual/normal-hematological-changes-during-pregnancy-and-the-puerperium/BF51446F36F0C11DA0CD81F72418D269>
18. Letsky E. Hematological Normal Ranges in Pregnancy [Internet]. The Global Library of Women's Medicine; 2008 [cited 2025 Aug 6]. Available from: <https://www.glowm.com/article/heading/vol-8--maternal-medical-health-and-disorders-in-pregnancy--hematological-normal-ranges-in-pregnancy/id/413403>
19. Yanai H, Shveiky D, Schonmann R, Boyko V, Meiner V, Hemo H, et al. High and Low Haemoglobin Levels in Early Pregnancy Are Associated to a Higher Risk of Miscarriage: A Population-Based Cohort Study. J Clin Med. 2021;10(11):2274. Available from:

- <https://pmc.ncbi.nlm.nih.gov/articles/PMC8151332/>
20. Khan S, Patail H, Khan A. Pregnancy-induced leukocytosis: A case report. Ann Med Surg (Lond). 2023;85(1):285-7. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9851002/>
21. Abhalan V, Dhumale H, Panditrao M. Platelet and White Blood Cell (WBC) Counts in the First Trimester and Pregnancy Outcome: Prospective Controlled Study. J Obstet Gynaecol India. 2019;69(Suppl 1):19-23. Available from: <https://www.thieme-connect.com/products/ejournals/abstract/10.1007/s40556-019-00202-0>
22. Abhalan V, Dhumale H, Panditrao M. Platelet and White Blood Cell (WBC) Counts in the First Trimester and Pregnancy Outcome: Prospective Controlled Study. J Obstet Gynaecol India [Internet]. 2019 [cited 2025 Aug 6];69(Suppl 1):19-23. Available from: <https://www.thieme-connect.com/products/ejournals/pdf/10.1007/s40556-019-00202-0.pdf>
23. Aliabadi T. Thrombocytopenia (low platelet count) in Pregnancy [Internet]. Dr. Thais Aliabadi. [cited 2025 Aug 6]. Available from: <https://www.drailiabadi.com/obstetrics/high-risk-obstetrics/gestational-thrombocytopenia/>
24. Incebiyik A, Hilali NG, Camuzcuoglu A, Vural M, Camuzcuoglu H. Association between platelet indices and first trimester miscarriage. J Matern Fetal Neonatal Med. 2016;29(13):2059-62. Available from: <https://pubmed.ncbi.nlm.nih.gov/26569515/>
25. Gunawani H, Singh Z, Singh N, Gupta A. Platelet Indices and Blood Groups in Early Recurrent Miscarriage: A Study in Pregnant Women. J Clin Gynecol Obstet. 2016;5(3):79-82. Available from: <https://jcgo.org/index.php/jcgo/article/view/170/62>
26. El-Gerdawy AAE, El-Maraghy MA, El-Sharkawy M, El-Sabaa H. The Association between Platelet Indices and Unexplained Recurrent Miscarriage. Evid Based Womens Health J [Internet]. 2021 [cited 2025 Aug 6];11(2):166-72. Available from: https://ebwhj.journals.ekb.eg/article_159960_9aa756d984c7ce0fe4d8ef5474b8af32.pdf

27. Brigham and Women's Hospital. Pregnancy and Hematology [Internet]. Brigham and Women's Hospital. [cited 2025 Aug 6]. Available from: <https://www.brighamandwomens.org/obgyn/maternal-fetal-medicine/pregnancy-and-medical-conditions/hematology>
28. MedlinePlus. Prenatal Panel [Internet]. National Library of Medicine; 2023 [cited 2025 Aug 6]. Available from: <https://medlineplus.gov/lab-tests/prenatal-panel/>
29. National Center for Biotechnology Information. Blighted ovum (Concept Id: C0266648) [Internet]. U.S. National Library of Medicine; [cited 2025 Aug 6]. Available from: <https://www.ncbi.nlm.nih.gov/medgen/540053>
30. Cofertility Team. Are There Different Types of Miscarriage? [Internet]. Cofertility; 2024 [cited 2025 Aug 6]. Available from: <https://www.cofertility.com/family-learn/types-of-miscarriage>
31. Hussein A. White blood cell Indices to predict first trimester missed miscarriage [Preprint]. ResearchGate; 2024 [cited 2025 Aug 6]. Available from: https://www.researchgate.net/publication/384750577_White_blood_cell_Indices_to_predict_first_trimester_missed_miscarriage