



## Placental abruption: Pathophysiology, prevalence, etiology, clinical manifestations, and roles of paramedics and EMS

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**Abstract---Background:** Placental abruption refers to the premature separation of a normally implanted placenta after the 20th week of gestation, often leading to maternal and fetal complications. It is classified as revealed or concealed, depending on the presence of vaginal bleeding. The condition's prevalence varies by region and is associated with various risk factors, including trauma, hypertension, and a history of prior abruption. **Aim:** This paper explores the pathophysiology, clinical manifestations, and prevalence of placental abruption, emphasizing the roles of paramedics and emergency medical services (EMS) in the management of affected patients. **Methods:** A comprehensive review of the literature was conducted, examining studies on the epidemiology, risk factors, pathophysiology, diagnosis, and management of placental abruption. The roles of paramedics and EMS in early identification, stabilization, and transport were highlighted. **Results:** Placental abruption affects approximately 1.2% of pregnancies, with a higher incidence in certain populations. The condition presents symptoms such as abdominal pain, back pain, and bleeding. Diagnosis often involves ultrasound, although its sensitivity is limited. Management depends on the

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severity of the abruption and gestational age, with early intervention critical for maternal and fetal outcomes. Paramedics and EMS play a crucial role in the early recognition, hemodynamic stabilization, and timely transport of patients to healthcare facilities. **Conclusion:** Placental abruption is a serious obstetric emergency that requires rapid assessment and intervention. The role of paramedics and EMS in ensuring timely care cannot be overstated, as their involvement significantly impacts maternal and fetal outcomes.

**Keywords**---placental abruption, preterm labor, fetal complications, paramedics, emergency medical services, pathophysiology, management.

## **Introduction**

Placental abruption refers to the premature separation of a normally implanted placenta after the 20th week of gestation, but before birth. This separation may be complete, resulting in fetal death, or partial, where only a segment of the placenta separates from the uterine wall. The condition can be classified as “revealed” or “concealed.” A revealed abruption is characterized by vaginal bleeding as blood tracks through the decidua and membranes to the cervix and vagina. In contrast, concealed abruption occurs without vaginal bleeding, as the blood accumulates behind the placenta without tracking through the cervix [1].

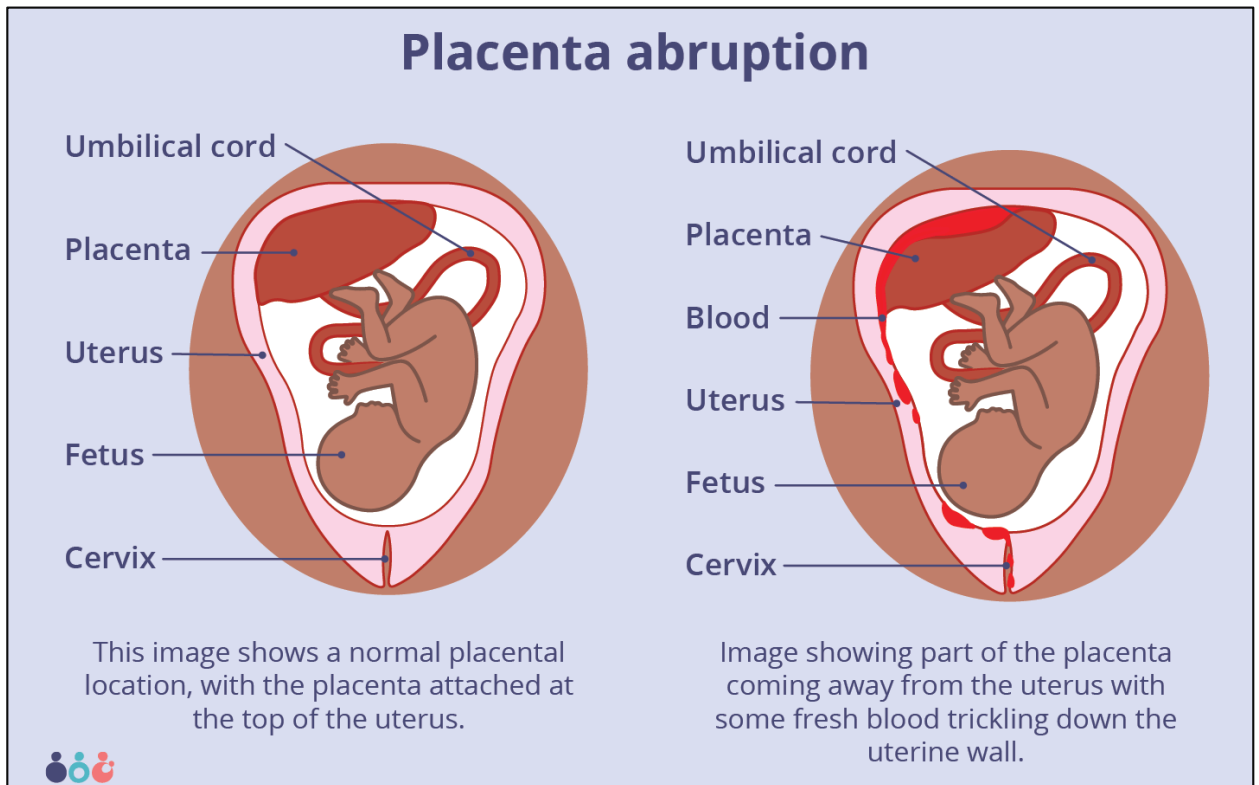
## **Prevalence and Epidemiology**

Placental abruption is diagnosed clinically and affects approximately 1.2% of pregnancies in the United States [2]. However, pathological examinations of placentas reveal a higher incidence ranging from 2.1% to 3.8%. While these cases, diagnosed solely via pathology, may not have clinical consequences, some experts argue that the term “placental abruption” should be reserved for clinical diagnoses [1]. The incidence of abruption has gradually increased in the United States over the past three decades, contrasting with the trends observed in European countries. In Canada, the incidence rose until the early 2000s, after which it began to decrease [2]. Notably, more than 50% of placental abruption cases occur before 37 weeks' gestation, with the highest incidence between 24 and 26 weeks, which decreases with advancing gestational age [1,3]. Various risk factors have been identified for placental abruption, many of which can be modified through patient behaviors. The history of abruption in a previous pregnancy is the most significant non-modifiable risk factor, increasing the risk by up to 15 to 20 times [4]. Other modifiable and non-modifiable factors include thrombophilia, amniocentesis, chorionic villus sampling, and genetic predispositions. However, results from studies on these factors are inconsistent, and they are not generally regarded as primary contributors to the occurrence of abruption [5–7].

## **Etiology and Pathophysiology**

The underlying physiology of placental abruption is not fully understood in many cases, but several risk factors involve identifiable pathophysiological mechanisms. In certain situations, shearing forces cause the placenta to separate from the uterine wall, leading to bleeding. This can occur in cases of trauma or rapid uterine decompression, such as in multifetal pregnancies or after membrane rupture with polyhydramnios [8]. Vasospasm and vasoconstriction of the small arterioles at the decidual-placental interface may cause areas of hypoxia and necrosis in the decidua, leading to venous hemorrhage and further separation of the placenta, resulting in more bleeding. This mechanism is thought to explain placental abruption in cases associated with cocaine use, shock/sepsis, or hypertensive urgency [1].

The majority of cases suggest that the process begins early, starting at trophoblastic invasion in the first trimester. Inadequate invasion leads to suboptimal remodeling of the uterine arterioles, a phenomenon observed in pregnancies complicated by preeclampsia [9]. This is reflected in abnormal serum analytes in cases of placental abruption, particularly low pregnancy-associated plasma protein A and increased alpha-fetoprotein, both of which are associated with improperly formed or damaged villi [10]. This hypothesis is further supported by the correlation between preeclampsia, growth restriction, and placental abruption. Additionally, there is an increased risk of hypertensive disorders in subsequent pregnancies for women with a history of abruption [11]. Regardless of the initial cause, the end result of the pathophysiologic process is the separation of the placenta from the decidua due to retroplacental bleeding, which reduces the placenta's functional surface area, potentially leading to more separation and bleeding.



**Figure 1:** Placental Abruption.

### Clinical Manifestations

The classical presentation of placental abruption includes abdominal pain and bleeding, although the presence or absence of these symptoms does not necessarily correlate with the severity of the condition. In concealed abruption, no vaginal bleeding occurs because the blood accumulates behind the placenta without tracking to the cervix. Back pain may also be a presenting symptom, particularly in cases of posterior placenta. On physical examination, findings may range from a benign exam to uterine tenderness, evidence of preterm labor, or a firm, tender uterus. Tocography may reveal uterine contractions, often presenting as high-frequency, low-amplitude contractions. When more than 50% of the placenta separates, fetal heart rate monitoring may show minimal or absent variability, and recurrent variable and late decelerations may be observed [1]. Maternal complications arising from placental abruption primarily result from hypovolemia and blood loss. In mild cases, there may be no significant maternal sequelae. However, more severe cases involving greater blood loss can lead to complications such as hypotension, shock, disseminated intravascular coagulopathy (DIC), and end-organ damage. Retroplacental bleeding may also cause uterine irritation and contractions, which can lead to preterm labor. In some cases, bleeding can cause uterine atony, resulting in a bluish appearance of the uterus, known as Couvelaire uterus. This condition increases the risk of blood loss due to uterine atony and associated complications. In rare instances, substantial blood loss may lead to maternal death.

Fetal complications are generally a consequence of reduced placental function. A decrease in the placenta's functional surface area can result in fetal hypoxia and morbidity associated with preterm delivery. If more than 50% of the placenta detaches, intrauterine fetal demise may occur. The perinatal mortality rate can range from 20% to 30%, persisting even after accounting for the mortality due to preterm delivery [13–15]. Chronic placental abruption may lead to preterm labor, preterm premature rupture of membranes (PPROM), oligohydramnios, and fetal growth restriction [16]. Ultrasound is often employed to diagnose placental abruption, but it plays a limited role in detecting the condition, especially in cases of concealed abruption. While ultrasound can visualize blood or clot in approximately 50% of suspected abruption cases, a negative ultrasound result does not rule out placental abruption [18]. The sensitivity of ultrasound for diagnosing abruption is around 25%, though its positive predictive value is relatively high, ranging from 82% to 100% [1,19]. Studies suggest that the location of the clot (retroplacental), the percentage of placental detachment (>50%), and fetal outcomes are positively correlated [16].

### **Ultrasound (US) in Placental Abruption Diagnosis**

Ultrasound is essential for detecting fetal anomalies, as pregnancies complicated by placental abruption exhibit a twofold increased risk of congenital anomalies [20].

### **Magnetic Resonance Imaging (MRI)**

Magnetic resonance imaging (MRI) has been investigated as a supplementary imaging tool for placental abruption. One study demonstrated a 100% positive detection rate using diffusion and T1-weighted MRI in 19 patients who were suspected of having an abruption, which was subsequently confirmed by placental pathology [21]. MRI is currently considered an investigational imaging technique following US but should not rule out the diagnosis of abruption in clinically suspected cases with negative MRI results. Additionally, MRI has shown utility in identifying abnormal placentation, such as placenta accreta, which can be distinguished from placental abruption [see Chapter 98].

### **Other Imaging Modalities**

Computed tomography (CT) is not commonly employed for placental abruption diagnosis. However, in pregnant patients already undergoing CT as part of trauma evaluation, it has proven effective in identifying abruptions. A study on the use of CT in evaluating placental abruption in trauma patients reported sensitivity ranging from 43% to 100% [22]. Due to the radiation exposure associated with abdominal/pelvic CT, it should be reserved for selective cases and not utilized as a primary diagnostic tool for placental abruption, even in cases with negative US results.

### **Imaging Findings of Placental Abruption**

The retroplacental hematoma appears as a heterogeneous hemorrhage located behind the placenta, with a small subchorionic component. In contrast, the

preplacental hematoma is a hemorrhage situated between the placenta and amniotic membrane, without leakage into the amniotic fluid cavity, preventing the characteristic "snowstorm" appearance in the amniotic fluid. A retroplacental hematoma with hypoechoic features suggests a resolving hematoma, appearing darker compared to the placenta.

### **Classic Signs of Placental Abruption**

A distinctive "jello" sign has been identified when evaluating placental abruption. This phenomenon occurs when the placenta or intrauterine clot is observed to "jiggle" upon the application of sudden pressure by the US transducer [1].

### **Differential Diagnosis**

Differentiation from other conditions is crucial in diagnosing placental abruption. Placenta previa must be ruled out in all instances of mid-gestation bleeding. Additionally, placenta accreta, increta, and percreta should be excluded, particularly in patients with a history of cesarean deliveries or intrauterine procedures. US findings indicative of abruption should be distinguished from succenturiate lobe, uterine fibroids, chorioangioma, placentomegaly, and molar pregnancy. The resolution of the suspected abnormality on follow-up examinations can assist in confirming the diagnosis of placental abruption [17].

### **Treatment Options for Placental Abruption** **Prenatal Management**

Management of placental abruption is personalized, with decisions based on gestational age, the severity of the abruption, and maternal and fetal well-being following the event. There are no large-scale studies evaluating specific interventions for pregnancies complicated by placental abruption [23]. The primary concern upon presentation with antepartum bleeding is the assessment of maternal and fetal health. Indicators of maternal hemodynamic instability, such as hypotension, tachycardia, and altered mental status, necessitate immediate stabilization, including fluid and blood product replacement. In these cases, delivery should be expedited regardless of gestational age. If coagulopathy is present, prophylactic anticoagulation should be considered for subsequent pregnancies [1].

Following a placental abruption, growth scans in future pregnancies are advisable due to the increased risk of growth restriction and hypertensive disorders, which have been associated with prior placental abruption complications [1, 11]. Delivery should also be expedited when fetal compromise is evident at viable gestational ages. At periviable gestations, when the mother is hemodynamically stable, a discussion should take place regarding the mode of delivery and potential interventions on behalf of the fetus. In the absence of maternal or fetal compromise, management is primarily guided by gestational age. Abruptions occurring at or beyond the late preterm period (34 weeks' gestation or later) should generally be managed by delivery. During the late preterm period, consideration may be given to delaying delivery for corticosteroid administration to promote fetal lung maturity [24]. In cases of extreme prematurity

(approximately 24–28 weeks' gestation), where the risks of prematurity outweigh the risks of prolonging pregnancy, conservative management may be considered. Hospitalization for close monitoring of maternal and fetal status is essential. Corticosteroids should be administered to aid fetal lung development, and serial assessments of fetal growth and well-being through monitoring and US are necessary. Additionally, maternal anemia and coagulopathy should be evaluated through laboratory assessments. Tocolysis can be considered in select cases, though its role in placental abruption remains controversial [18, 25, 26]. Vaginal delivery can be pursued in cases where both fetal and maternal conditions permit [1].

### **Postnatal Management**

In the postpartum period, pregnancies complicated by placental abruption face an increased risk of hemorrhage due to the heightened likelihood of uterine atony [12]. Women with a history of placental abruption are at a significantly elevated risk of recurrence, with a potential 20-fold increased risk in subsequent pregnancies [1, 4]. One of the primary goals of care in these cases is to address modifiable risk factors, such as smoking and substance abuse cessation, the treatment of chronic hypertension, and dietary adjustments to mitigate the risk of gestational diabetes. Patients should also be counseled to wait at least two years between pregnancies, as short-interval pregnancies are linked to an increased risk of recurrent abruption [1]. Routine screening for inherited thrombophilias following an abruption is not recommended due to insufficient evidence supporting the use of prenatal anticoagulation prophylaxis to prevent recurrence. However, for patients with known thrombophilias and a history of abruption, individualized care should be considered.

### **Key Points for Referring Physicians**

A low threshold for diagnosing placental abruption should be maintained in cases of antepartum hemorrhage, as clinical presentations are varied, and a negative US result does not rule out the condition. Ultrasound should be utilized to exclude placenta previa and abnormal placentation. Expedited delivery is required when maternal or fetal compromise is present, while management in the absence of compromise is primarily guided by gestational age. The history of placental abruption is the most significant risk factor for recurrence; hence, reducing modifiable risk factors is critical for future pregnancies. Close surveillance is necessary in subsequent pregnancies to monitor potential complications [31].

### **Key Highlights**

Placental abruption complicates approximately 1% of pregnancies but carries substantial maternal and fetal morbidity. Placental abruption is fundamentally a clinical diagnosis. Ultrasound is not sufficiently sensitive for diagnosing abruption, and a negative result should not exclude the diagnosis. Ultrasound should be used to rule out placenta previa or abnormal placentation in cases of bleeding beyond 20 weeks' gestation. Management is individualized, based on the severity of bleeding, clinical manifestations, and gestational age [31].

**Role of Paramedics and Emergency Medical Services:**

Placental abruption, a critical obstetric emergency, occurs when the placenta prematurely separates from the uterine wall, leading to significant maternal and fetal risks. The role of paramedics and Emergency Medical Services (EMS) in the management of placental abruption is pivotal in ensuring immediate care, early recognition, and transport to appropriate medical facilities. Early intervention and coordinated care are essential for improving maternal and neonatal outcomes. This paper explores the role of paramedics and EMS in managing placental abruption, including recognition, assessment, stabilization, and transport strategies.

**Early Recognition and Initial Assessment**

One of the most significant roles of paramedics is the early recognition of placental abruption. While it is a rare condition, accounting for approximately 1% of pregnancies, its potential for causing severe complications such as maternal hemorrhage, shock, and fetal distress makes it a priority in emergency care. The hallmark symptoms of placental abruption include vaginal bleeding, abdominal pain, and uterine tenderness, often with signs of maternal distress. Paramedics must be trained to recognize these symptoms promptly, as early detection can significantly impact clinical outcomes. Paramedics are also responsible for conducting an initial assessment to evaluate the severity of the condition. This includes assessing vital signs, such as blood pressure, heart rate, and oxygen saturation, to determine if maternal hypovolemic shock is present. Maternal hypotension, tachycardia, and altered mental status are signs of severe hemorrhage and require immediate intervention. Additionally, fetal distress, indicated by abnormal fetal heart rate patterns, should be identified, as it signals a risk for fetal compromise and the potential need for urgent delivery. The initial clinical assessment is essential to guide decision-making in the field, particularly when managing the patient's airway, breathing, and circulation. The paramedic team must assess whether the mother is hemodynamically stable or if advanced interventions such as fluid resuscitation or blood product administration are required to stabilize her condition before transport. Recognizing these early signs ensures that EMS professionals take appropriate action to manage the potential complications of placental abruption.

**Stabilization and Hemorrhage Control**

Once placental abruption is suspected, the primary focus of paramedics is to stabilize the patient. Hemorrhage control is critical, as uncontrolled bleeding can lead to maternal shock, coagulopathy, and even death. Paramedics should begin by administering intravenous fluids to restore circulating blood volume and prevent shock. The use of isotonic crystalloids, such as normal saline or Ringer's lactate, is typically the first-line intervention. Blood transfusions may be required if there is significant blood loss, and paramedics should coordinate closely with the receiving hospital to ensure that blood products are available upon arrival. In cases of maternal hypotension, rapid infusion of fluids may be necessary, followed by the administration of blood products if the bleeding is severe. Paramedics should also monitor for signs of disseminated intravascular coagulation (DIC), a

condition that can result from severe placental abruption, where clotting mechanisms become overwhelmed, leading to both internal bleeding and clotting. Monitoring for signs of shock and abnormal bleeding allows EMS personnel to adjust interventions promptly and tailor care to the patient's condition.

### **Fetal Monitoring and Transport Decisions**

During the management of placental abruption, fetal monitoring is an integral part of assessing the fetus's well-being. Paramedics should attempt to monitor fetal heart tones using a Doppler or fetal heart rate monitor, as this can provide valuable information regarding fetal distress. If fetal heart rate abnormalities are noted, such as bradycardia or variable decelerations, this may indicate fetal hypoxia, necessitating rapid transport to a facility with appropriate neonatal care capabilities. The decision to transport the patient is guided by several factors, including maternal and fetal stability. In cases where maternal or fetal compromise is evident, rapid transport to a hospital with a higher level of obstetric and neonatal care may be necessary. Time is of the essence in placental abruption, as the condition can deteriorate quickly, requiring immediate intervention. EMS teams must be familiar with the available medical resources in the region and work closely with receiving hospitals to prepare for the patient's arrival. In some cases, paramedics may need to provide ongoing stabilization during transport, such as continuing fluid resuscitation or preparing for possible emergency delivery upon arrival.

### **Communication and Coordination with Receiving Facilities**

Effective communication between paramedics and receiving medical facilities is critical for the successful management of placental abruption. EMS personnel must provide a clear and concise report to the receiving hospital, detailing the patient's clinical presentation, the degree of maternal and fetal compromise, and any interventions that have been performed en route. This allows the receiving obstetric and neonatal teams to prepare for the patient's arrival and facilitates timely decision-making upon their transfer. Coordination with the obstetric team is particularly important, as they will need to assess the need for immediate delivery, either vaginal or cesarean, based on the severity of the abruption and fetal condition. Paramedics should ensure that the hospital has the necessary resources, including blood products, operating room facilities, and neonatal intensive care unit (NICU) staff, to handle potential complications. Early collaboration between EMS and hospital teams ensures that care is streamlined and that the patient receives timely and appropriate intervention.

### **Psychological Support and Family Communication**

In addition to the clinical care provided, paramedics must also offer psychological support to the patient and their family. Placental abruption can be a traumatic event for both the mother and her family, particularly when fetal compromise is suspected. Providing reassurance, explaining the interventions being performed, and keeping family members informed about the patient's condition can help alleviate anxiety and ensure better cooperation during transport. The role of paramedics and EMS in managing placental abruption is crucial in the early

identification, stabilization, and timely transport of patients experiencing this life-threatening condition. Early recognition of symptoms, effective hemorrhage control, fetal monitoring, and coordination with receiving facilities are essential to improving maternal and fetal outcomes. Paramedics must work in close collaboration with obstetric and neonatal teams to provide the best possible care, ensuring that both the mother and fetus receive appropriate treatment during the critical stages of placental abruption. With proper training and preparedness, EMS personnel play a vital role in managing this obstetric emergency and reducing the risks associated with this potentially catastrophic condition.

## **Conclusion**

Placental abruption is a potentially life-threatening condition that requires timely intervention to minimize maternal and fetal morbidity and mortality. It is associated with a variety of risk factors, including previous cases of abruption, hypertension, and trauma. While its pathophysiology is not fully understood, the condition is characterized by the premature separation of the placenta from the uterine wall, which can lead to significant bleeding, uterine irritability, and fetal hypoxia. Early diagnosis and intervention are paramount, and paramedics and emergency medical services (EMS) play a crucial role in the initial management and stabilization of patients with suspected placental abruption. Paramedics are often the first healthcare professionals to encounter a patient experiencing placental abruption, and their ability to recognize the signs and symptoms of this condition can significantly affect the outcome. Although placental abruption is often suspected based on clinical presentation, diagnostic imaging such as ultrasound is typically employed for confirmation. However, the sensitivity of ultrasound is not high, particularly in cases of concealed abruption, where no vaginal bleeding occurs. Given the potential for rapid deterioration, especially in cases of severe abruption, paramedics must assess maternal vital signs, administer appropriate fluid resuscitation, and ensure timely transport to a medical facility for further evaluation and delivery if necessary. In terms of management, paramedics should focus on stabilizing the patient by preventing shock through fluid replacement and preparing for potential complications such as disseminated intravascular coagulopathy (DIC) or uterine atony. Paramedics should also be prepared to assist in pain management and provide supportive care, including oxygen administration for both the mother and fetus if signs of fetal distress are observed. Emergency medical services must also be prepared to work in collaboration with receiving hospitals, ensuring that the transfer is coordinated and that the hospital staff is alerted to the patient's condition. The critical nature of placental abruption means that decisions regarding the timing of delivery must be made quickly, often with little regard for the gestational age, as maternal stability is the priority. In severe cases, early delivery may be required regardless of fetal maturity. In less severe cases, conservative management may be attempted, but close monitoring is necessary. Overall, the roles of paramedics and EMS in placental abruption are essential in ensuring that patients receive the prompt and appropriate care necessary to optimize outcomes. The ability of paramedics to rapidly identify, assess, and manage this obstetric emergency can make a significant difference in reducing the risk of maternal and fetal complications. As with many emergencies, early intervention is key to improving both maternal and fetal health outcomes. Therefore, continued education and

training for paramedics in the recognition and management of placental abruption are crucial for maintaining optimal care standards in the prehospital setting.

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## انفصال المشيمة: الفيزيولوجيا المرضية، الانتشار، الأسباب، الأعراض السريرية، وأدوار المسعفين وخدمات الطوارئ الطبية

### الملخص:

**الخلفية:** يشير انفصال المشيمة إلى الانفصال المبكر للمشيمة المزروعة بشكل طبيعي بعد الأسبوع العشرين من الحمل، مما يؤدي في كثير من الأحيان إلى مضاعفات للأم والجنين. يتم تصنيفه إلى نوع مكشوف أو مخفي، بناءً على وجود نزيف مهلي. يختلف انتشار هذه الحالة حسب المنطقة وترتبط بمجموعة من عوامل الخطر، بما في ذلك الصدمات، ارتفاع ضغط الدم، وتاريخ انفصال المشيمة السابق.

**الهدف:** تهدف هذه الورقة إلى استكشاف الفيزيولوجيا المرضية، الأعراض السريرية، وانتشار انفصال المشيمة، مع تسليط الضوء على أدوار المسعفين وخدمات الطوارئ الطبية في إدارة المرضى المتأثرين.

**المنهجية:** تم إجراء مراجعة شاملة للأدبيات، حيث تم فحص الدراسات المتعلقة بالوبائيات، عوامل الخطر، الفيزيولوجيا المرضية، التشخيص، وإدارة انفصال المشيمة. كما تم تسليط الضوء على أدوار المسعفين وخدمات الطوارئ الطبية في التعرف المبكر، والاستقرار، والنقل.

**النتائج:** يؤثر انفصال المشيمة على حوالي 1.2% من حالات الحمل، مع وجود نسبة أعلى في بعض الفئات السكانية. وتظهر الحالة أعراضًا مثل الألم البطني، ألم الظهر، والنزيف. غالبًا ما يتضمن التشخيص فحص الموجات فوق الصوتية، على الرغم من أن حساسيته محدودة. يعتمد العلاج على شدة الانفصال وعمر الحمل، حيث يعد التدخل المبكر أمرًا بالغ الأهمية لنتائج الأم والجنين. يلعب المسعفون وخدمات الطوارئ الطبية دورًا حيويًا في التعرف المبكر، استقرار الحالة الديناميكية الدموية، والنقل في الوقت المناسب للمرضى إلى المنشآت الصحية.

**الخلاصة:** يعتبر انفصال المشيمة حالة طوارئ نسائية خطيرة تتطلب التقييم والتدخل السريع. لا يمكن التقليل من دور المسعفين وخدمات الطوارئ الطبية في ضمان الرعاية في الوقت المناسب، حيث إن مشاركتهم تؤثر بشكل كبير على نتائج الأم والجنين.

**الكلمات المفتاحية:** انفصال المشيمة، الولادة المبكرة، مضاعفات الجنين، المسعفون، خدمات الطوارئ الطبية، الفيزيولوجيا المرضية، الإدارة.