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Postpartum Bleeding: Definition, Diagnostic Approaches, and Management Protocols in Contemporary Research

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ABSTRACT

The present study aimed to review the definition, diagnostic approaches, and management protocols of postpartum hemorrhage in contemporary research. Postnatal bleeding refers to hemorrhage originating from the parturient canal, occurring either during the early or late period following childbirth. In most cases, postnatal bleeding occurs as a complication of significant obstetric conditions. The severity of this condition is largely determined by the volume of blood lost. Globally, postpartum bleeding is recognized as the leading contributor to maternal morbidity and mortality. According to data from the World Health Organization (WHO), postpartum hemorrhage is responsible for approximately 75% of maternal deaths, translating to over 70,000 fatalities worldwide each year. The clinical consequences of this condition include the immediate risk of hemorrhagic shock, potential multi-organ failure, complications related to blood transfusion, the development of chronic anemia, and the necessity for admission to specialized hospital units equipped with intensive care resources. Despite advancements in clinical protocols and preventive strategies aimed at controlling blood loss, the widespread implementation of these guidelines in routine obstetric practice remains a pressing medical and social challenge. This is due to its significant contribution to maternal death and its profound impact on both physical health and psychological well-being. It is important to emphasize that, even with existing methods for anticipating blood loss, adherence to active management protocols, and the application of preventive and laboratory measures, postpartum bleeding continues to be a critical and unresolved concern in modern obstetrics.

Keywords: Compression suture, Postpartum bleeding, Uterotonic therapy, Maternal mortality, Uterine massage

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Introduction

At present, postpartum hemorrhage (PB) remains the leading factor contributing to both maternal morbidity and mortality during childbirth. On a global scale, postpartum bleeding accounts for approximately 8% of maternal deaths in developed nations, while in developing regions, it contributes to nearly 20% of maternal mortality cases. The distribution of the causes of maternal death within the Russian Federation is illustrated in **Figure 1**.

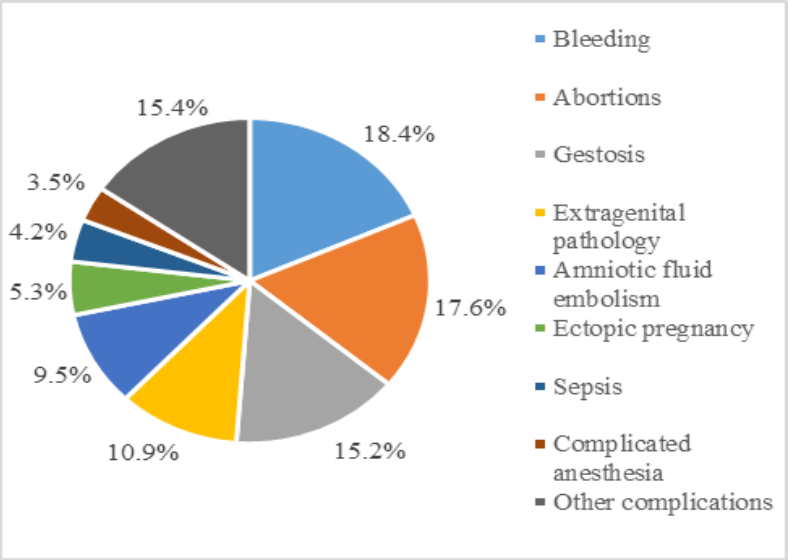

Figure 1. The structure of the reasons for maternal death in the Russian Federation (2020-2022)

During pregnancy, the typical blood flow directed to the uterus reaches approximately 600 milliliters per minute, a significant increase compared to the 60 milliliters per minute observed outside the gestational period [1]. The primary mechanism for controlling postnatal bleeding relies largely on the effective contraction of the uterus, with the activation of the clotting cascade playing a secondary role in hemostasis. Postpartum hemorrhage (PB) is defined as blood loss occurring either during spontaneous vaginal delivery or during surgical childbirth (Cesarean section), with the threshold being more than 500 milliliters in vaginal births and over 1000 milliliters in surgical deliveries, or any clinically important bleeding that develops within six weeks following childbirth [2]. PB is categorized as primary when it occurs within the first 24 hours after delivery, and secondary when the bleeding develops between 24 hours and up to 12 weeks postpartum [3]. The etiological factors leading to PB are commonly summarized by the "4Ts" classification: tone (associated with uterine atony), trauma (injury or rupture of the uterus), tissue (retention of placental fragments or blood clots), and thrombin (coagulopathy due to deficiency of blood clotting factors), as illustrated in **Figure 2** [2].

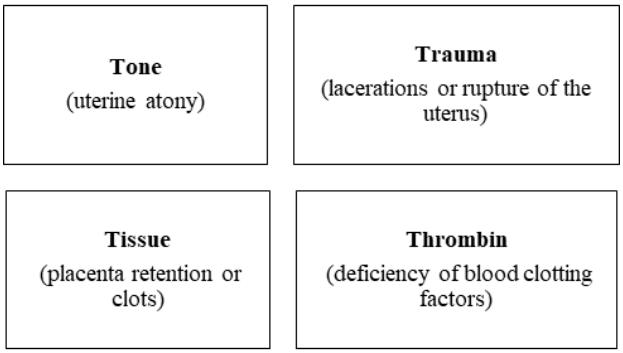

Figure 2. Causes of postpartum bleeding

Uterine atony is recognized as the most frequent cause of postpartum hemorrhage (PB), accounting for approximately 70% of all cases. This is followed by obstetric lacerations, which contribute to around 20% of cases, retention of placental tissue observed in nearly 10%, and coagulation factor deficiencies, which are responsible for less than 1% of cases [2]. PB can lead to severe complications, including chronic anemia requiring blood transfusions, disseminated intravascular coagulation (DIC), the necessity for hysterectomy, multi-organ failure, and even maternal death [2].

Hypotonic uterus or uterine atony as the underlying cause of PB may result from several predisposing conditions, such as chorioamnionitis, therapeutic use of magnesium sulfate, prolonged or precipitous labor, presence of uterine fibroids, overdistension of the uterus in cases of multiple gestations, fetal macrosomia, or polyhydramnios. It is particularly important to highlight that Cesarean section poses a higher risk for postpartum hemorrhage when

compared to vaginal delivery. Additionally, factors like advanced maternal age and high parity further increase the likelihood of PB occurrence [4].

Comprehensive analysis of large-scale population-based studies has identified several key risk factors for PB, including retention of placental fragments, trauma associated with obstetric procedures, hypertensive disorders, labor induction with oxytocin, fetal macrosomia, and eclampsia. Nevertheless, despite efforts to identify women at increased risk for this life-threatening condition, PB can still develop suddenly in patients without any evident predisposing factors [5]. Therefore, continuous monitoring and caution are necessary after every childbirth to promptly recognize and manage this complication.

The present study aimed to examine the definition, diagnostic approaches, and management protocols of postpartum hemorrhage in contemporary research.

Materials and Methods

As part of this scientific investigation, an extensive review of literature was carried out, analyzing articles, abstracts, and research materials available in leading academic databases. The search focused on specific keywords, including “postpartum bleeding”, “maternal mortality”, “uterotonic therapy”, “uterine massage”, and “compression suture”. Information was sourced from widely recognized platforms such as PubMed, Hindawi, CyberLeninka, and Google Scholar, with unrestricted access to the required materials. Additionally, a manual search for relevant literature was performed to supplement the electronic database search and ensure comprehensive data collection.

Results and Discussion

To prevent severe outcomes for the young mother, effective management of potential postpartum bleeding is crucial. This process requires a well-coordinated strategy where the role of the medical team is essential. Initially, it is vital to monitor the woman's vital signs and maintain her physiological stability. An accurate estimation of the volume of blood lost is necessary, and when required, medications should be used to control the bleeding, along with artificial resuscitation measures [6]. The continuous monitoring of blood loss is a critical component in managing postpartum hemorrhage. This can be done through visual inspection or by weighing blood-saturated materials, such as surgical sponges and sheets [7]. While there is no definitive evidence supporting one method over another, quantitative techniques provide a more accurate assessment of blood loss compared to subjective evaluations [8]. Integrating blood loss quantification into maternal care protocols could help reduce morbidity in cases of severe postpartum hemorrhage.

Despite certain limitations, some obstetric societies prefer to assess blood loss by weighing blood-soaked materials (such as sponges or pads), monitoring the amount of irrigation fluid used, and using graduated cylinder bandages during postpartum bleeding events [9]. Recent advancements have also led to increased interest in colorimetric methods and the use of electronic AI tools, such as smartphone apps, for real-time blood loss monitoring [10]. For women at high risk of postpartum hemorrhage, it is recommended to insert two large-bore intravenous cannulas ahead of time. High-risk cases include complete placenta previa and active vaginal bleeding. A blood sample should also be taken for a complete blood count. Ongoing monitoring must be tailored to the specific cause and risk level of the bleeding. This may involve continuous oxygen saturation monitoring, urine output measurement via catheterization, cardiovascular assessment, and blood clotting evaluation using parameters like prothrombin time, fibrinogen levels, and activated partial thromboplastin time [2]. In patients with a very high risk of postpartum bleeding, both venous and arterial central catheters should be placed. To prevent hypothermia, which is common during extensive fluid resuscitation and prolonged surgeries, a water-circulating heating pad or forced air warming system can be utilized. While crystalloids offer a slight advantage over colloids, the latter can also be used effectively [11].

Postpartum examination of the placenta is essential to rule out the presence of retained placental tissue or abnormal placental lobes connected to the main placenta by blood vessels. If retained tissue is suspected, it should be removed via manual exploration or using a banjo curette under ultrasound guidance. Ultrasound has a prognostic value of approximately 58% for detecting retained placental tissue and 87% for ruling it out [12]. Additionally, a thorough inspection of the lower genital tract for potential ruptures in the cervix, vagina, perineum, or rectovaginal area is critical. Any ruptures should be immediately sutured with absorbable sutures.

Bimanual uterine massage is typically the first approach in managing postpartum hemorrhage due to uterine atony. The massage encourages uterine contractions by stimulating the release of endogenous prostaglandins [13]. Oxytocin, administered either intravenously or intramuscularly, is the primary treatment for postpartum bleeding related to uterine atony. Oxytocin is generally given concurrently with uterine massage, except when used as a preventive measure. The uterine response to intravenous oxytocin is typically rapid, with a plasma half-life of one to six minutes [14].

When pharmacological treatments are ineffective for uterine atony, mechanical interventions are used, such as balloon tamponade and uterine compression sutures. Balloon tamponade, first introduced in 2001 with the Bakri balloon, involves placing an intrauterine balloon that is inflated with up to 500 ml of fluid. The balloon is typically removed within 24 hours, and its purpose is to exert pressure to reduce or stop the bleeding from the uterus [15]. Research conducted in 2020 found that balloon tamponade systems are safe and effective, with a success rate higher than 85% in managing postpartum hemorrhage [10]. Uterine compression sutures, introduced by B-Lynch *et al*. [16], have become a widely used method for controlling postpartum bleeding. Over time, different techniques for uterine compression sutures have emerged, and multiple systematic reviews and case series report a success rate of over 90% when using corset sutures for hemorrhage management [17]. While effective, these sutures can lead to complications like uterine necrosis or the development of intrauterine synechiae. Blood transfusions are typically indicated when blood loss exceeds 1500 ml or when significant hemodynamic changes are observed. For large-volume transfusions, such as more than 10 units of red blood cells within 24 hours or over 4 units in 45-60 minutes, the process must begin promptly [18]. Preventive measures for postpartum bleeding should ideally be considered even before pregnancy, with special attention to women at higher risk. This includes addressing iron deficiency and improving hemoglobin levels. Monitoring during pregnancy and labor for factors contributing to bleeding risk can help in planning appropriate interventions, including choosing the best facility for delivery [19].

Conclusion

Postpartum hemorrhage continues to be a major clinical challenge, leading to significant complications and maternal death. Around the world, a woman dies from postnatal bleeding approximately every seven minutes. Even with advancements in predicting blood loss, implementing active management strategies, and using preventive measures and laboratory techniques, this condition remains a critical issue in modern medicine.

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