

## Serum Ferritin as an Early Predictor of Postpartum Hemorrhage Risk: A Prospective Observational Study

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### Abstract

*Postpartum hemorrhage (PPH) remains a leading cause of maternal morbidity and mortality worldwide, particularly in low- and middle-income countries. Identifying early predictors of PPH risk is crucial for timely intervention and prevention of life-threatening complications. **Serum ferritin**, an indicator of iron stores, has gained attention as a potential biomarker for predicting PPH due to its association with maternal anemia and impaired uterine contractility. This prospective observational study aims to evaluate the predictive value of serum ferritin levels in anticipating PPH among antenatal women nearing term. Eligible pregnant women were enrolled during their third-trimester antenatal visits and underwent serum ferritin estimation along with hemoglobin and complete blood count. Participants were followed through labor and delivery, and PPH was defined according to WHO criteria. The study examined correlations between maternal ferritin levels and the incidence of PPH, while also analyzing confounding variables such as parity, mode of delivery, nutritional status, and antenatal iron supplementation. Statistical comparisons were performed between women who developed PPH and those who did not. The results demonstrated that **low serum ferritin levels were significantly associated with an increased risk of PPH**, even after adjusting for hemoglobin levels and other risk factors. Women with ferritin levels below the recommended threshold showed higher rates of atonic PPH, greater need for uterotonics, and higher blood transfusion requirements. These findings highlight the potential role of serum ferritin as a valuable early screening tool, enabling clinicians to implement preventive strategies such as optimized antenatal iron therapy, active management of the third stage of labor, and heightened postpartum monitoring. The study underscores the importance of addressing **maternal iron deficiency** not only to correct anemia but also to reduce the burden of*

*obstetric hemorrhage. Overall, serum ferritin assessment may serve as a cost-effective, accessible, and reliable predictor for improving maternal outcomes in resource-limited settings.*

**Keywords:** *Serum ferritin, postpartum hemorrhage, maternal anemia, early predictor, antenatal care, obstetric risk factors*

## **Introduction :**

Postpartum hemorrhage (PPH) is a major public health concern globally and remains a leading cause of maternal mortality, particularly in developing regions where access to emergency obstetric care is limited (**Fraser et al., 2019**). PPH is commonly defined as blood loss exceeding 500 mL after vaginal delivery or 1000 mL following cesarean section. The etiology includes uterine atony, retained placenta, genital tract trauma, and coagulation disorders, among which **uterine atony accounts for nearly 70%** of cases (**Singh et al., 2018**). Maternal anemia is an important contributing factor to PPH severity, compromising the body's ability to tolerate blood loss and leading to rapid clinical deterioration. Serum ferritin, a marker of iron stores, plays a crucial role in understanding the interplay between iron deficiency and maternal outcomes. Recent literature suggests that low ferritin levels may impair myometrial function, thereby contributing to poor uterine contractility and increased PPH risk (**Moreno et al., 2020**). Although hemoglobin measurement is routinely performed during antenatal care, it does not reliably reflect iron stores, making serum ferritin a potentially more accurate predictor of maternal vulnerability. Women with low iron reserves may appear clinically stable but possess insufficient physiological capacity to withstand peripartum blood loss. Identifying such women early in the antenatal period can improve preparedness and guide interventions to reduce PPH incidence. Preventive strategies based on risk identification include optimizing antenatal iron supplementation, preparing for active management of the third stage of labor, and ensuring availability of blood products. This study aims to evaluate the association between serum ferritin levels and postpartum hemorrhage in third-trimester pregnant women. By analyzing prospective data, the study seeks to determine whether ferritin can serve as a reliable early biomarker. Furthermore, despite its potential, serum ferritin testing is not routinely utilized in many obstetric setups, particularly in resource-limited areas such as rural India. Understanding its predictive value may prompt policymakers and clinicians to consider integrating ferritin screening into routine antenatal protocols. This research is therefore positioned at the intersection of maternal health optimization and preventive obstetric care. The findings of

this study may contribute to strengthening clinical decision-making, minimizing adverse maternal outcomes, and addressing the global challenge of PPH through a simple, cost-effective diagnostic parameter.

### **Materials and Methods :**

This prospective observational study was conducted in the Department of Obstetrics & Gynaecology, Rama Medical College & Hospital, Hapur, from June 2022 to Dec. 2024. Uttar Pradesh, over a period of twelve months. Ethical approval was obtained from the institutional ethics committee prior to initiation. The study population consisted of pregnant women in their third trimester attending routine antenatal check-ups. Inclusion criteria were pregnant women aged 18–40 years with singleton pregnancies, gestational age between 34 and 40 weeks, and willingness to participate. Exclusion criteria included chronic medical illnesses such as renal disease, liver disorders, hemoglobinopathies, autoimmune disorders, ongoing infections, multiple gestation, or previously diagnosed coagulation abnormalities. After obtaining informed consent, each participant underwent detailed clinical evaluation including obstetric history, nutritional assessment, parity, socioeconomic background, and previous PPH history. Blood samples were collected to estimate serum ferritin levels using a standard chemiluminescent immunoassay. Hemoglobin and complete blood count were performed using automated analyzers. Additional parameters such as mean corpuscular volume and red cell distribution width were recorded to assess underlying iron-deficiency patterns. Serum ferritin thresholds were categorized as: <15 ng/mL (severe deficiency), 15–30 ng/mL (moderate deficiency), 30–50 ng/mL (mild deficiency), and >50 ng/mL (normal iron stores), based on WHO guidelines (WHO, 2021). All participants were followed until delivery. Labor progression was monitored using standard protocols. Active management of the third stage of labor was implemented for all participants. PPH was defined as blood loss >500 mL after vaginal delivery or >1000 mL after cesarean section, assessed using gravimetric techniques and clinical estimation. Additional indicators such as need for additional uterotonics, blood transfusion, drop in hemoglobin level, and hemodynamic instability were documented. Participants were categorized into two groups: those who developed PPH and those who did not. Statistical analysis included comparison of serum ferritin levels between groups using t-tests and chi-square tests. Logistic regression was applied to identify serum ferritin as an independent predictor while adjusting for confounders including parity, anemia, mode of delivery, and BMI. A p-value <0.05 was considered statistically significant. The methodology ensured robust prospective data collection and minimized recall bias. Monitoring ferritin levels in the antenatal period provided insight into maternal iron status and allowed correlation with postpartum outcomes. The study further evaluated whether ferritin provided predictive value beyond hemoglobin alone, which is traditionally used but often limited in

diagnosing early iron depletion. Throughout the study, maternal safety was prioritized with timely interventions, counseling, and proper intrapartum monitoring. This comprehensive methodological approach supports reliable conclusions regarding the relationship between ferritin levels and PPH risk.

### **Results:**

A total of 200 women were enrolled, of whom 186 completed follow-up through delivery. Among participants, 32 (17.2%) developed postpartum hemorrhage. Mean serum ferritin levels were significantly lower in the PPH group ( $18.6 \pm 7.4$  ng/mL) compared to the non-PPH group ( $42.8 \pm 12.3$  ng/mL) ( $p < 0.001$ ). Severe ferritin deficiency ( $< 15$  ng/mL) was observed in 53% of women who developed PPH, compared to only 12% in the non-PPH group. Hemoglobin levels were also lower in the PPH group, but logistic regression showed that **serum ferritin was a stronger independent predictor** of PPH risk (OR = 4.56, 95% CI 2.01–8.44). Atonic PPH was the most common type, with higher need for additional uterotonics and blood transfusion in women with low ferritin. The study also found that multiparity, prolonged labor, and instrumental delivery were associated factors but did not diminish the predictive strength of ferritin. Cesarean deliveries showed slightly higher incidence of PPH in women with ferritin  $< 20$  ng/mL. Maternal outcomes such as hemodynamic instability and postpartum anemia were more pronounced in the low-ferritin group. Overall, the results strongly indicate that reduced serum ferritin levels significantly increase PPH risk, independent of hemoglobin concentration and other variables.

**Discussion :** This study demonstrates that **serum ferritin is a valuable early predictor of postpartum hemorrhage**, aligning with findings from recent research (**Moreno et al., 2020; Fraser et al., 2019**). Low ferritin levels compromise uterine contractility and maternal physiological reserves, increasing vulnerability to hemorrhage. Compared to hemoglobin, ferritin offers a more sensitive measure of iron deficiency and better identifies women at risk. Incorporating ferritin screening into antenatal care may significantly improve preparedness and reduce maternal morbidity. The results support its use in developing targeted preventive strategies for PPH, particularly in resource-limited settings.

**Conclusion:** This prospective observational study evaluated serum ferritin as an early predictor of postpartum hemorrhage among third-trimester pregnant women. Findings revealed that women with low serum ferritin levels had significantly higher rates of PPH, greater need for additional

uterotonics, and increased blood transfusion requirements. Serum ferritin emerged as a stronger predictor than hemoglobin, emphasizing its clinical utility. The study highlights the importance of early identification of iron deficiency to improve maternal outcomes. Integrating ferritin testing into routine antenatal protocols may support timely intervention and reduce the burden of PPH, particularly in high-risk populations.

## References :

- Fraser, M., Cooper, M., & Nolte, A. (2019). *Myles Textbook for Midwives (17th ed.)*. Elsevier.
- Singh, A., Chawla, Y., & Kaur, P. (2018). Clinical patterns and risk factors of postpartum hemorrhage in tertiary care settings. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, 7(6), 2301–2306.
- Moreno, E., Martínez, A., & López, L. (2020). Ferritin as a biochemical marker in high-risk pregnancies: Implications for postpartum hemorrhage. *Journal of Maternal-Fetal & Neonatal Medicine*, 33(14), 2394–2400.
- World Health Organization. (2021). *WHO Guideline: Iron Supplementation in Pregnancy*. WHO Press.
- Roberts, C. L., Ford, J. B., & Algert, C. S. (2017). Trends and recurrence of postpartum hemorrhage. *Obstetrics & Gynecology*, 129(3), 416–423.
- Gupta, R., & Rao, N. (2016). Iron deficiency in pregnancy and its impact on obstetric outcomes. *Indian Journal of Hematology and Blood Transfusion*, 32(2), 247–252.
- Sharma, S., Verma, M., & Singh, R. (2019). Evaluation of anemia as a risk factor for postpartum hemorrhage. *Journal of Clinical and Diagnostic Research*, 13(10), QC08–QC11.
- Wilson, D., & Clarke, M. (2020). Predictive markers of obstetric hemorrhage: A systematic review. *BMC Pregnancy and Childbirth*, 20(1), 134.
- Tanaka, H., Matsumoto, K., & Suzuki, Y. (2015). Uterine contractility and iron deficiency: A mechanistic study. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 194, 71–75.
- Mehta, P., Shah, S., & Dholakia, K. (2018). Prepartum ferritin levels and risk of postpartum hemorrhage: A prospective analysis. *Journal of Obstetrics and Gynaecology Research*, 44(9), 1659–1665.
- Dilla, A. J., Waters, J. H., & Yazer, M. H. (2013). Clinical estimation vs. quantitative measurement of postpartum blood loss. *American Journal of Obstetrics & Gynecology*, 208(5), 468.e1–468.e6.
- Qureshi, Z., Sekhvat, L., & Saghafian, S. (2021). Iron deficiency and obstetric complications: A clinical overview. *Obstetric Medicine*, 14(4), 224–230.
- Patel, A., & Sinha, R. (2017). Role of ferritin in evaluating iron status in pregnancy: Clinical correlations. *International Journal of Gynecology & Obstetrics Research*, 5(2), 51–56.
- Lee, N., & Morgan, J. L. (2014). Predictors and management of postpartum hemorrhage: Review of current evidence. *Current Opinion in Obstetrics and Gynecology*, 26(6), 447–453.
- Harrison, M. S., Ononge, S., & Mirembe, F. (2019). Incidence and risk factors for postpartum hemorrhage in low-resource settings. *BMC Pregnancy and Childbirth*, 19(1), 465.