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Original Research

Risk Factors for Postpartum Anemia Among Immediate Postpartum Women at a Peruvian Air Force Hospital

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Abstract

Background: Postpartum anemia remains common and undermines early recovery. We aimed to identify risk factors for postpartum anemia among immediate postpartum women at a Peruvian Air Force hospital. **Methods**: We conducted a retrospective case-control study at the Central Hospital of the Peruvian Air Force (Lima, Peru) from January to December 2024, including 120 immediate postpartum women (55 cases with postpartum anemia; 65 controls without). Data were abstracted from standardized medical records and analyzed using bivariate tests and logistic regression. **Results**: Postpartum anemia occurred in 45.8% of women. In bivariate analyses, fewer prenatal visits (median 9 vs. 10; $p = 0.030$) and antenatal anemia (25.5% vs. 0.0%; $p < 0.001$) were associated with postpartum anemia. In the adjusted model, prenatal visits showed a marginal inverse association (adjusted odds ratio [aOR] = 0.86; 95% confidence intervals [CI]: 0.74–1.01; $p = 0.060$). No significant associations were found for education, marital status, parity, mode of delivery, body mass index (BMI), or gestational weight gain. Antenatal anemia was excluded from the multivariable model because of perfect prediction. **Conclusions**: In this cohort, fewer prenatal visits showed a marginal association with immediate postpartum anemia, while antenatal anemia was the dominant risk factor. Practice should prioritize timely third-trimester hemoglobin screening and correction of antenatal anemia, reliable iron-folate supply with adherence support, and immediate postpartum testing with structured discharge counseling, with targeted counseling for women with antenatal anemia or fewer prenatal visits.

Keywords: good health and well-being; postpartum anemia; postnatal women; maternal health; Peru

1. Introduction

Postpartum anemia is common in both high- and low-resource settings and is linked to impaired maternal recovery and adverse maternal-infant outcomes [1]. The World Health Organization (WHO) defines postpartum anemia as hemoglobin <11 g/dL at one week or <12 g/dL at one year after delivery, typically resulting from uncorrected iron deficiency during pregnancy or significant peripartum blood loss [2]. In Latin America, prevalence among pregnant women has been reported between 20% and 39%, while pooled estimates in Ethiopia indicate a 27% prevalence of immediate postpartum anemia, underscoring the global persistence of this problem [3,4]. Consequences include fatigue, cognitive impairment, postpartum depression, and disruptions in maternal-infant bonding, documented across diverse health-system contexts [5–7].

Regionally, studies from Latin America describe heterogeneous antenatal screening coverage and variable adherence to iron supplementation, with postpartum anemia persisting despite high facility-delivery rates [3,8,9]. In Peru, hospital-based work reports high postpartum anemia, particularly among women with antenatal anemia, inconsistent supplementation, or puerperal complications, and follow-up and patient education remain limited [8, 10,11]. Similar gaps in postpartum laboratory monitoring have been observed in Uruguay and Spain, and severe postpartum anemia has been associated with rehospitalization, transfusion, and poor outcomes in cohorts from sub-Saharan Africa, the United States, and Norway [3,6,12, 13]. Together, these findings point to recurring deficits in follow-up, education, and system response despite established recommendations.

International guidance calls for routine screening and coordinated, multidisciplinary care; however, implementation is inconsistent, especially in low-resource settings [13]. Evidence from low- and middle-income countries highlights insufficient patient education, inconsistent supplementation practices, and limited postpartum care as persistent barriers [14,15]. The lack of harmonized strategies for risk assessment, follow-up, and nutritional counseling reinforces the need for locally relevant research to clarify setting-specific risk factors and inform targeted interventions [15].

Evidence from military or other standardized-care health systems remains limited, particularly in Latin America. These systems follow uniform pathways, protocolized antenatal hemoglobin screening and iron-folate supplementation, immediate postpartum hemoglobin testing, and structured discharge counseling and patient profiles and resource flows may differ from civilian public hospitals. Estimates derived from mixed civilian cohorts may therefore not generalize to military institutions. To address this gap, we examined risk factors for immediate postpartum anemia within a standardized military care environment at the Central Hospital of the Peruvian Air Force.

2. Materials and Methods

2.1 Study Design and Setting

We conducted a retrospective case-control study at the Central Hospital of the Peruvian Air Force (Lima, Peru). The study covered all eligible deliveries from January to December 2024. No clinical interventions were performed.

2.2 Population and Sample

The study population comprised all immediate postpartum women (within 24 hours after delivery) who received care at the Central Hospital of the Peruvian Air Force between January and December 2024. We used a census of all records meeting the inclusion criteria; no sampling was applied. The final analytic sample was 120 women: 55 cases (postpartum anemia) and 65 controls (no postpartum anemia). Although numerically modest, this sample represents the entire eligible population over one calendar year at this specialized institution, minimizing selection bias and supporting internal validity. No a priori power calculation was performed because of the census design; the sample size reflects the institutional caseload, and multivariable modeling was deliberately limited to avoid overfitting. Because we used a census of all eligible records over one calendar year, no a priori sample-size calculation was performed. To enhance transparency, we report observed effect sizes and their 95% confidence intervals rather than post hoc power, which can be misleading when based on the observed data.

2.3 Inclusion and Exclusion Criteria

Participants were included if they delivered at Hospital Central FAP in 2024, were in the immediate postpartum period, had hemoglobin results available from the third trimester and within six hours after delivery, and had no documented hematologic disease. Records were excluded if they were incomplete, illegible, or in poor physical condition, or if the woman had autoimmune disease, chronic kidney disease, or liver cirrhosis. Only these exclusion criteria were applied; otherwise, all eligible records were included. Women were not excluded based on postpartum hemorrhage because quantitative blood-loss estimation was inconsistently recorded; restricting the cohort by a potentially underreported diagnosis could introduce selection bias.

2.4 Variables and Data Collection Instrument

Primary outcome. Immediate postpartum anemia was defined, per institutional protocol, as hemoglobin $<$10.0 g/dL within 6 hours after delivery; severe postpartum anemia as hemoglobin $<$7.0 g/dL. This threshold is the unit's clinical trigger for evaluation and treatment in the immediate postpartum window. It is stricter than WHO thresholds defined at later postpartum time points (e.g., $<$11 g/dL at 1 week and $<$12 g/dL at 1 year). We selected the institutional definition to prioritize early, clinically actionable identification in our standardized military-care setting.

All variables were prespecified based on established clinical evidence and were abstracted using a structured data-collection form. Sociodemographic variables included educational level (primary/secondary vs. higher), marital status (single/cohabiting vs. married), occupation (self-employed vs. employed/military), and multiparity ($\leq$3 vs. $>$3 children). Obstetric variables comprised the number of prenatal visits (count), mode of delivery (cesarean vs. vaginal), episiotomy (yes/no), and soft-tissue lacerations (yes/no). Clinical/nutritional variables included history of anemia during pregnancy (positive if third-trimester hemoglobin $<$11 g/dL), gestational weight-gain risk (per national and international guidelines), and body mass index (BMI, kg/m^2) categorized per WHO: normal (18.5–24.9), overweight (25.0–29.9), and obese ($\geq$30.0). Classification criteria: BMI categories followed WHO cutoffs [16]. Gestational weight-gain risk was defined relative to prepregnancy BMI according to Institute of Medicine/National Academy of Medicine recommendations and the aligned national guideline, classifying values outside the recommended range as "at risk" [17]. Data availability: Dietary quality, adherence to iron supplementation, and quantitative estimates of peripartum blood loss were not consistently recorded in medical charts and were therefore unavailable for analysis. Multiple gestation status and detailed obstetric blood loss beyond a binary clinical diagnosis were also inconsistently captured.

Operational definitions are summarized in **Supplementary Table 1**.

2.5 Data Collection Procedure and Quality Control

Retrospective data were abstracted by the principal investigator and a trained assistant under strict confidentiality protocols. Medical records were reviewed onsite in the hospital archive. Records that did not meet eligibility criteria or contained missing critical data were excluded from analysis. To ensure accuracy, a 10% random subset of charts was re-abstracted by a second reviewer; the subset was selected by simple random sampling using a computer-generated sequence and discrepancies were resolved by consensus.

Missing Data

Diet quality, adherence to iron-folate supplementation, and quantitative blood loss were not consistently recorded in charts and were unavailable for analysis; multiple gestation status and detailed blood-loss metrics beyond a binary clinical diagnosis were also inconsistently captured. We performed a complete-case analysis without imputation and acknowledge potential residual confounders from these unavailable covariates. We did not restrict the cohort by postpartum hemorrhage diagnoses because under-recording could introduce selection bias.

2.6 Statistical Analysis

Data were entered into Microsoft Excel and analyzed with SPSS version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, median, and interquartile range) were used to summarize baseline characteristics. Bivariate analyses were performed using chi-square or Fisher's exact test for categorical variables and Mann-Whitney U test for non-normally distributed continuous variables. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to estimate the strength of association between risk factors and postpartum anemia. We used two-tailed tests with $\alpha = 0.05$. Variables with $p < 0.05$ in bivariate analyses were considered for multivariable logistic regression. p-values are reported to two decimals (using $p < 0.001$ when appropriate).

Reporting conventions. Percentages are reported with one decimal place. Effect sizes (e.g., OR) and 95% CIs are reported with two decimals. p-values are reported with two decimals, using "$p < 0.001$" when applicable.

In addition to p-values, we reported effect sizes: Cramér's V for χ^2/Fisher tests and rank-biserial r (Cliff's delta) for Mann-Whitney U comparisons, alongside ORs with 95% CIs from logistic models. We did not compute post hoc power given its known interpretational limitations; observed effect sizes and CIs are provided to convey magnitude and precision.

Reporting of crude vs. adjusted ORs. The crude OR is the coefficient from a univariable logistic regression with postpartum anemia as the outcome and number of prenatal visits as the sole predictor (per additional visit). Crude ORs are from univariable logistic regression; adjusted ORs are from the final multivariable model. Because "anemia during pregnancy" caused complete separation (0.0% among controls), it was excluded; the final model retained only "number of prenatal visits" (per additional visit). Both effects are per additional visit. The small numerical differences between crude and adjusted estimates (0.85 [0.74–0.99] vs. 0.86 [0.74–1.01]) reflect re-estimation in the final model and rounding to two decimals.

3. Results

3.1 Univariate Analysis

Table 1 presents the clinical and sociodemographic characteristics of women in the immediate postpartum period included in the study (n = 120; controls without postpartum anemia, n = 65; cases with postpartum anemia, n = 55). The table summarizes educational level, marital status, occupation, and multiparity; obstetric factors including number of prenatal visits (count), mode of delivery, episiotomy, and soft-tissue lacerations; and clinical/nutritional factors including anemia during pregnancy, gestational weight-gain risk, and BMI categorized per WHO (normal 18.5–24.9; overweight 25.0–29.9; obese $\geq$30.0 kg/m^2). Data are shown as n (%) for categorical variables and median interquartile range (IQR) for counts. As shown in Table 1, the median number of prenatal visits was lower in cases than controls 9 (IQR 9–11) vs. 10 (IQR 9–11); BMI is presented in WHO categories with explicit ranges.

3.2 Bivariate Analysis

Bivariate results. Fewer prenatal visits (median 9 vs. 10; p = 0.030) and anemia during pregnancy (25.5% vs. 0.0%; $p < 0.001$) were associated with postpartum anemia. No between-group differences were observed for education, marital status, occupation, BMI category, gestational weight-gain risk, mode of delivery, episiotomy, or soft-tissue lacerations (all $p > 0.050$) (Table 2).

3.3 Multivariate Analysis

In the adjusted model, the number of prenatal visits showed a directionally protective association that did not reach conventional significance (aOR = 0.86; 95% CI: 0.74–1.01; p = 0.060). "Anemia during pregnancy" was excluded due to perfect prediction (0% among controls), which prevents stable maximum-likelihood estimation. Its unadjusted contrast (25.5% vs. 0.0%; $p < 0.001$) indicates the strongest factor in this cohort and is therefore highlighted in the Results and revisited in the Discussion as a clinically dominant upstream risk marker (Table 3).

4. Discussion

In bivariate analyses, anemia during pregnancy showed a very strong association with immediate postpartum anemia, and women with postpartum anemia had fewer prenatal visits than controls. In the multivariable model, the number of prenatal visits was not statistically significant but suggestive (aOR = 0.86; 95% CI: 0.74–1.01; p = 0.060). Anemia during pregnancy could not be estimated because of perfect prediction; nevertheless, its bivariate contrast (25.5% vs. 0.0%; $p < 0.001$) indicates the strongest factor in this cohort. The exclusion of anemia during pregnancy from the multivariable model reflects complete separation rather than a lack of effect. Given its 0.0% prevalence among controls and the large unadjusted contrast, this variable likely represents a dominant upstream determinant, consistent with prior literature. Larger studies could use penalized likelihood (e.g., Firth) to obtain adjusted estimates under separation; nonetheless, our findings support preventing and correcting antenatal anemia as a primary clinical priority.

Our finding of antenatal anemia as the dominant upstream factor, alongside a marginal inverse association for prenatal-visit number, aligns with reports from Latin American hospital cohorts and from standardized-care or military systems. In Uruguay's military hospital population,

Table 1. Baseline characteristics of immediate postpartum women.

Variable	n (%)
Group (case/control)	
Control	65 (54.2)
Case	55 (45.8)
Sociodemographic factors	
Educational level	
Primary/Secondary	19 (15.8)
Higher	101 (84.2)
Marital status	
Single/Cohabiting	13 (10.8)
Married	107 (89.2)
Occupation	
Self-employed	35 (29.2)
Employed/Military	85 (70.8)
Multiparity	
≤3 children	103 (85.8)
>3 children	17 (14.2)
Obstetric factors	
Number of prenatal visits (case)	9 (IQR 9–11)
Number of prenatal visits (control)	10 (IQR 9–11)
Type of delivery	
Cesarean	97 (80.8)
Vaginal	23 (19.2)
Episiotomy	
No	97 (80.8)
Yes	23 (19.2)
Soft-tissue lacerations	
Absent	98 (81.7)
Present	22 (18.3)
Clinical factors	
Anemia during pregnancy	
Negative	106 (88.3)
Positive	14 (11.7)
Gestational weight-gain risk	
No	61 (50.8)
Yes	59 (49.2)
BMI kg/m^2	
Normal (18.5–24.9)	15 (12.5)
Overweight (25.0–29.9)	56 (46.7)
Obese (≥30.0)	49 (40.8)

Values are n (%) unless otherwise indicated; percentages rounded to one decimal. Number of prenatal visits is shown as median (IQR). BMI categories follow World Health Organization (WHO) cutoffs. BMI, body mass index; n, number of samples; IQR, interquartile range.

pregnancy-related anemia has remained prevalent despite organized pathways [3]. Peruvian hospital-based studies similarly report high postpartum anemia, especially among women with antenatal anemia or suboptimal supplementation and limited follow-up [10,11]. Outside Latin America, a multi-hospital study in Saudi Arabia identified antenatal anemia as the strongest predictor of postpartum anemia and found no independent effect for low prenatal-visit counts, consistent with our adjusted findings [18]. European evidence also underscores how system processes screening timing, monitoring, discharge education shape detection and management of postpartum anemia [6,12].

Taken together, our results support a protocolized bundle for comparable standardized-care settings: (1) third-trimester hemoglobin screening with prompt correction of antenatal anemia; (2) reliable iron-folate supply with adherence support at each contact; (3) immediate postpartum hemoglobin testing (within 6 hours where this clinical trigger is used) coupled with structured discharge counseling; and (4) early follow-up within 1–2 weeks to reassess symptoms, reinforce adherence, and arrange intravenous (IV) iron when indicated. These steps mirror recommendations and implementation levers described in recent guidance and landscape reviews [12,13,15].

Fewer prenatal contacts can delay screening for antenatal anemia, reduce opportunities for counseling and refills of iron supplementation, and limit timely correction of deficiency mechanisms that plausibly increase immediate postpartum risk. Strengthening protocolized antenatal screening and adherence support may therefore mitigate postpartum anemia even where sociodemographic gradients are modest.

Findings regarding prenatal visits are heterogeneous across the literature. Several studies did not identify visit number as an independent predictor after adjustment, in line with our marginal adjusted result [18–21]. By contrast, other reports observed higher risk with fewer or no visits: lack of antenatal care independently predicted postpartum anemia (aOR = 2.92; 95% CI: 1.20–7.06) in Agmassie *et al.* [22], and fewer than four visits increased the risk of immediate postpartum anemia (aOR = 3.18; 95% CI: 1.53–6.61) in Abebe *et al.* [23]. Alshahrani *et al.* [18], however, found no significant association when comparing <3 vs. ≥3 visits (p = 0.50). These discrepancies likely reflect differences in population characteristics, definitions of antenatal-care adequacy, timing of hemoglobin assessment, and health-system context such as the high baseline level of standardized care in our military cohort rather than contradictory biology. Taken together, the literature and our data emphasize prioritizing care-process quality screening timeliness, counseling intensity, and refill adherence over visit counts alone in prevention strategies.

Our results and prior evidence also underscore the central role of anemia during pregnancy. Strong adjusted associations have been reported across settings: preoperative anemia predicted postpartum anemia following cesarean section (aOR = 14.5; 95% CI: 4.11–51.16) in Habtamu *et al.* [19]; pre-delivery hemoglobin <11 g/dL independently increased immediate postpartum anemia (aOR = 5.46; 95% CI: 3.09–9.67) in Abebe *et al.* [23]; and pre-delivery anemia was the strongest predictor (aOR = 4.99;

Table 2. Unadjusted associations with postpartum anemia (bivariate analysis).

Variable	Postpartum Anemia in Immediate Postpartum Women		p-value
	Cases (n = 55) n (%)	Controls (n = 65) n (%)	
Sociodemographic factors			
Educational level			0.520
Primary/Secondary	10 (18.2)	9 (13.8)	
Higher	45 (81.8)	56 (86.2)	
Marital status			0.540
Single/Cohabiting	7 (12.7)	6 (9.2)	
Married	48 (87.3)	59 (90.8)	
Occupation			0.410
Self-employed	14 (25.4)	21 (32.3)	
Employed/Military	41 (74.6)	44 (67.7)	
Multiparity			0.350
≤3 children	49 (89.1)	54 (83.1)	
>3 children	6 (10.9)	11 (16.9)	
Obstetric factors			
Number of prenatal visits	9 (IQR 9–11)	10 (IQR 9–11)	0.030
Type of delivery			0.830
Cesarean	44 (80.0)	53 (81.5)	
Vaginal	11 (20.0)	12 (18.5)	
Episiotomy			0.830
No	44 (80.0)	53 (81.5)	
Yes	11 (20.0)	12 (18.5)	
Soft-tissue lacerations			0.660
Absent	44 (80.0)	54 (83.1)	
Present	11 (20.0)	11 (16.9)	
Clinical factors			
Anemia during pregnancy			<0.001
Negative	41 (74.5)	65 (100.0)	
Positive	14 (25.5)	0 (0.0)	
Gestational weight-gain risk			0.700
No	29 (52.7)	32 (49.3)	
Yes	26 (47.3)	33 (50.7)	
BMI kg/m^2			0.400
Normal (18.5–24.9)	8 (14.6)	7 (10.8)	
Overweight (25.0–29.9)	22 (40.0)	34 (52.3)	
Obese (≥30.0)	25 (45.4)	24 (36.9)	

Values are n (%); percentages rounded to one decimal. Two-tailed χ^2/Fisher for categorical variables and Mann-Whitney U for the number of prenatal visits.

Footnote: "Anemia during pregnancy" shows perfect prediction (0.0% among controls); see Methods and Results for handling and interpretation.

Table 3. Multivariable logistic regression for postpartum anemia.

Variables	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Obstetric factors				
Number of prenatal visits	0.85 (0.74–0.99)	0.030	0.86 (0.74–1.01)	0.060

Adjusted odds ratios (ORs) reported with 95% confidence intervals (CIs); p-values to two decimals.

Footnote: Crude OR from univariable logistic regression; Adjusted OR from the final multivariable model after excluding "anemia during pregnancy" due to complete separation. Both effects are per additional prenatal visit. Minor differences reflect refitting and rounding; both indicate a small protective association.

95% CI: 1.84–13.50; $p = 0.002$) in Alshahrani *et al.* [18]. Liu *et al.* [24] further linked antenatal anemia with postpartum hemorrhage ($p = 0.025$), while one study did not confirm an adjusted effect [22]. Although our multivariable model could not estimate this predictor due to perfect prediction, the 25.5% vs. 0% contrast in our bivariate analysis confirms its dominant role and reinforces the clinical priority of preventing and correcting maternal anemia during pregnancy.

Null findings for education, parity, delivery type, and BMI have also been reported elsewhere. For education, several analyses did not identify a significant adjusted effect [18,20,21], whereas Abebe *et al.* [23] found that lack of formal education increased risk (aOR = 3.92; 95% CI: 1.85–8.33). Regarding parity, Alshahrani *et al.* [18] observed no association with postpartum anemia ($p = 0.309$) but noted greater anemia severity among women with only one previous delivery ($p = 0.043$), while Habtamu *et al.* [19] reported that primiparity was inversely associated with postpartum anemia after cesarean section (aOR = 0.47; 95% CI: 0.24–0.92). For mode of delivery, several studies including ours did not find an independent association [18,19,21], although others reported higher risk in specific contexts (e.g., prior cesarean section or cesarean delivery vs. vaginal birth: AOR = 3.40; 95% CI: 1.89–6.10 and aOR = 4.10; 95% CI: 2.11–7.78, respectively) [23,25]. For BMI, Alshahrani *et al.* [18] found no relationship with postpartum anemia, and Liu *et al.* [24] noted that pre-delivery anthropometrics did not predict postpartum hemorrhage after adjustment. In our relatively homogeneous, standardized-care environment with high prenatal-care uptake, between-patient variability in these characteristics may be attenuated, shifting risk toward modifiable process measures (screening, supplementation adherence, discharge education).

Limitations

This study has strengths and limitations. Strengths include a census-based design across a full calendar year, standardized operational definitions, and a structured quality-control process with independent re-abstraction of a random subset of charts. Although the total sample was modest (n = 120), it represents the entire eligible population at this specialized institution, minimizing selection bias and supporting internal validity.

This single-center census with a modest sample (n = 120) limits precision for modest effects and constrains external validity. Moreover, our standardized military tertiary-care context (e.g., high cesarean rate) may differ from civilian facilities in patient mix, care pathways, and resource flows, so effect sizes may not translate directly outside similar systems. Missing information on adherence, dietary quality, and quantitative blood loss could leave residual confounders. Accordingly, generalizability is greatest to comparable standardized-care systems (e.g., organized military hospitals) and should be evaluated cautiously elsewhere; multicenter, prospective cohorts that capture process-quality metrics alongside biologic risk are warranted [3,15].

5. Conclusions

In summary, this study identified the number of prenatal visits as the main factor associated with postpartum anemia among immediate postpartum women at a Peruvian Air Force Hospital. Other sociodemographic, obstetric, and clinical variables including educational level, multiparity, type of delivery, and body mass index were not significantly associated with postpartum anemia in this population. These findings underscore the crucial role of comprehensive and sustained prenatal care in reducing the risk of postpartum anemia. Strengthening antenatal surveillance and prioritizing the early detection and management of anemia during pregnancy should be central components of both clinical practice and public health strategies. Our results offer important local evidence that enriches the current understanding of postpartum anemia and highlight the need for context-specific interventions to improve maternal health outcomes in Peru and comparable settings.

Availability of Data and Materials

The datasets generated and analyzed during the current study are not publicly available due to institutional and patient confidentiality policies, but are available from the corresponding author upon reasonable request.

Author Contributions

CAMM and MAAH designed the research study. CAMM collected and curated the data. MAAH performed the formal analysis. CAMM and KAHB developed the study methodology. KAHB and MAAH supervised the research process. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki. The research protocol was approved by the Institutional Committee of Ethics and Scientific Integrity of Universidad Privada Norbert Wiener (Ethics Approval Number: Exp. N°: 0271-2025). Additional authorization for data collection was granted by the Department of Education, Teaching, and Research of the Central Hospital FAP (Approval Code: NC-50-HCDE-N°011). Informed consent was waived due to the retrospective nature of the study and the use of anonymized medical records without direct patient contact.

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.31083/CEOG45331.

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