

Analysis of hemorrhage at vaginal delivery by erythrocyte and hematocrit indices

Análise da hemorragia no parto vaginal pelos índices de eritrócitos e hematócrito

Maria Cristina Gabrielloni¹
Cláudia Junqueira Armellini²
Márcia Barbieri¹
Janine Schirmer¹

Keywords

Hemorrhage; Postpartum hemorrhage; Parturition; Obstetrical nursing; Hematocrit; Erythrocyte indices

Descritores

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Corresponding author

Maria Cristina Gabrielloni
Napoleão de Barros street, 754, São Paulo, SP, Brazil. Zip Code: 04024-002
crisgabrielloni@gmail.com

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Abstract

Objective: To analyze hemorrhage at vaginal delivery using hemoglobin and hematocrit indices.

Methods: This was a cross-sectional study of 328 vaginal deliveries divided into spontaneous delivery with or without episiotomy and forceps delivery. The sample was randomly stratified by type of vaginal delivery. Data were collected at admission for delivery, hospital discharge and postpartum return visit.

Results: There were 122 (37.2%) deliveries without episiotomy, 147 (44.8%) with episiotomy, and 59 (18.0%) with forceps delivery and episiotomy. Hemoglobin values between admission for delivery and discharge ranged from -5.9 g/dl to 0.7 g/dl. Hemoglobin reduction was significantly higher in women having forceps delivery than in those with spontaneous deliveries, with and without episiotomy ($p=0.0133$ and $p<0.0001$, respectively). Hemorrhage was greater in the forceps delivery group than in the other groups.

Conclusion: The analysis of hemorrhage at vaginal delivery by using hemoglobin and hematocrit indices showed variation among the three types of vaginal delivery studied. There was greater hemorrhage with forceps delivery and less hemorrhage with spontaneous delivery. In women with forceps delivery, postpartum indices were lower than those at hospital admission.

Resumo

Objetivo: Analisar a hemorragia no parto vaginal através dos índices de eritrócitos e hematócrito.

Métodos: Estudo transversal realizado em 328 partos vaginais divididos em: espontâneo, com e sem episiotomia, e parto fórceps. A amostragem foi aleatória estratificada por tipo de parto vaginal. Os dados foram coletados na internação para o parto, na alta hospitalar e no retorno puerperal.

Resultados: Foram estudados 122 (37,2%) partos sem episiotomia, 147 (44,8%) com episiotomia e 59 (18,0%) com uso de fórceps e episiotomia. O valor individual de hemoglobina, entre a internação para o parto e a alta hospitalar variou de -5,9 g/dl a 0,7 g/dl. A redução da hemoglobina foi significativamente maior no parto fórceps comparado aos partos espontâneos, com e sem episiotomia, $p=0,0133$ e $p<0,0001$, respectivamente. No parto fórceps a hemorragia é maior quando comparada aos outros tipos de parto

Conclusão: A análise da hemorragia no parto vaginal através dos índices de eritrócitos e hematócrito evidenciou que há variação nos três tipos de parto vaginal estudados, sendo a hemorragia maior no parto fórceps e menor no parto vaginal espontâneo. No puerpério, nos casos de partos fórceps estes índices mantiveram-se inferiores aos da internação.

¹Escola Paulista de Enfermagem, Universidade Federal de São Paulo, São Paulo, SP, Brazil.

²Escola de Enfermagem, Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.

Conflicts of interest: none reported.

Introduction

Blood loss during intra- and postpartum can change hematologic conditions of women. For this reason, obstetric researchers have studied bleeding in this setting.^(1,2)

Causes of postpartum hemorrhage in vaginal delivery can be associated with prior postpartum hemorrhage, induction or conduction of delivery, third period of prolonged delivery, preeclampsia, nulliparity, failure to fetal descent, forceps or vacuum extraction delivery, third or fourth-degree perineal laceration, retained placenta, macrosomia, vaginal or perineal laceration that requires suture, multiple gestation, and episiotomy.^(2,3)

Visual estimation is a widely used method to assess blood loss after delivery.⁽⁴⁾ Since 1960, reports have shown a discrepancy between blood loss determined by visual examination and by objective techniques at delivery.⁽⁵⁻⁸⁾ Methods used to assess blood loss include use of calibrated recipients and laboratory techniques to determine plasma volume and red blood cells before and after delivery using radioisotope labels.^(8,9)

Mean blood loss during vaginal delivery ranges from 197 ml to 505 ml, and it can be influenced by the assessment method.⁽²⁾ In clinical practice, when blood loss greater than expected is suspected, hematimetric values are applied to determine the management approach.

Blood loss during vaginal or cesarean delivery is not determined routinely, nor are hemoglobin and hematocrit values during the postpartum period.

A study by the World Health Organization in Asia that evaluated the relationship between types of delivery and maternal and perinatal results reported higher mortality rates with forceps delivery than with vaginal spontaneous delivery (odds ratio, 3.1; 95% confidence interval, 1.5-6.5). Forceps delivery, cesarean delivery with antepartum indication for such delivery, and cesarean delivery with or without intrapartum indication significantly increased the risk of blood transfusion compared with spontaneous delivery.⁽¹⁰⁾

Hemorrhage is the main direct cause of maternal death throughout the world, especially during

the postpartum period, with a rate of 25%.⁽¹¹⁾ In Brazil, analysis that group causes of maternal death showed that hemorrhage was the second most frequent cause of death.

Given the potential impact of maternal blood loss due to delivery, this study sought to analyze hemorrhage during vaginal delivery by using hemoglobin and hematocrit indices.

Methods

This cross-sectional study was conducted in two hospital of the Brazilian public health system in São Paulo, southeast Brazil.

The study population was composed of 328 women divided into groups according to type of delivery: spontaneous with episiotomy, spontaneous without episiotomy, and forceps delivery. Inclusion criteria were primiparity, full-term gestational age, one fetus, live fetus in cephalic presentation, and record of at least three prenatal visits without clinical or obstetrics comorbidities. Exclusion criteria were occurrence of third- or fourth-degree perineal laceration, blood transfusion, and presence of comorbidity.

The sample was randomly stratified by type of vaginal delivery, considering a 95% confidence interval. The calculated sample size was 308 deliveries, with an error up to 3% in relation to the real results of the population: 144 vaginal delivery with episiotomy, 109 deliveries without episiotomy and 55 forceps deliveries.

The dependent variable, hemorrhage, was evaluated by using the erythrocyte indices of hemoglobin and hematocrit values at hospital admission for delivery, discharge, and postpartum return visit. Type of partum, an independent variable, was categorized as spontaneous delivery, with or without episiotomy, and forceps delivery. Control variables were age, formal education level, marital status, occupation, number of prenatal visits and quarter of first prenatal visit, medical prescription for and use of iron supplement in pregnancy and in the postpartum period, gestational age, use of oxytocin during labor and the third period of la-

bor, presence and type of perineal laceration, and newborn's birth weight.

Data were collected upon admission for delivery, at discharge (36 to 72 hours postpartum), and at the postpartum return visit (15 to 22 days postpartum) using blood samples collected in a tube with EDTA K₂ anticoagulant; hemoglobin level and hematocrit at each phase were measured.

Hematologic levels were obtained by blood biochemistry analysis with automatic cell counting using a Celm CC530 cell counter and diluter and evaluation of double counting in a Neubauer chamber.

The Student *t*-test was used to assess differences in hematologic profile, and the chi-square test was used to compare several categories, establishing a 95% confidence interval. Data were analyzed by using the statistical software JMP/SAA, version 8.0.2.

Development of this study followed national and international ethical standards for research on human subjects.

Results

This study included 328 women who underwent vaginal delivery. Of them, 122 (37.2%) did not have episiotomy, 147 (44.8%) had episiotomy, and 59 (18.0%) had forceps delivery with episiotomy.

Sociodemographic features included a mean maternal age of 21.7 ± 4.9 years (range, 14 to 39 years). In addition, 62.5% of patients were age >19 years, 72.0% had completed high school, 69.5% had a husband, and 64.3% did not work. Women with the three types of delivery were similar with regard to age, formal education level, marital status, and occupation.

Mean gestational age was 39 weeks and 4 days (SD±1.0). We recorded six or more prenatal visits regardless of the type of delivery; more than half of the pregnant women began medical visits in the first quarter of the pregnancy. Prescription of iron supplement ranged from 88.1% to 100.0% according to type of delivery; at least ≥61.5 of women using the supplement.

Oxytocin was used during delivery by at least 78.7% of women, regardless of the delivery type. An association between oxytocin use during labor and delivery type was seen ($p=0.0435$). Frequency of oxytocin use was significantly higher in the episiotomy group than in the group with spontaneous delivery and episiotomy ($p=0.0299$).

Most episiotomies were right mediolateral. Perineal laceration occurred in 8.2% and 69.7% of women and was more frequent in the spontaneous delivery without episiotomy group. There was an association between presence of laceration and type of delivery ($p=0.0001$). Laceration was significantly less frequent in women who had spontaneous delivery with episiotomy than in those with spontaneous delivery without episiotomy and forceps delivery ($p=0.0000$ and $p=0.0000$, respectively).

First-degree laceration was significantly more frequent in the group with spontaneous delivery without episiotomy than in the group with spontaneous delivery with episiotomy ($p=0.0029$) and forceps delivery, in which episiotomy is commonly performed, ($p=0.000$). Second-degree laceration was significantly more common at spontaneous delivery with episiotomy than at spontaneous delivery without episiotomy ($p=0.0000$) and spontaneous delivery without episiotomy compared with forceps delivery ($p=0.000$).

The use of oxytocin in the third stage of labor was ≥71.3% or greater, regardless of type of delivery. An association between the use of oxytocin during this period and type of delivery was observed ($p<0.0001$). Oxytocin use was significantly greater in the spontaneous delivery with episiotomy group than in the group with spontaneous delivery without episiotomy ($p=0.0013$).

Newborn birth weight ranged between 2210 g and 4440 g, and the mean weight was 3.262 ± 396.29 g. This range in women with spontaneous delivery with episiotomy was higher and significant differed compared with the range in the spontaneous delivery without episiotomy group ($p=0.0011$).

An iron supplement was prescribed to all women after delivery and at hospital discharge. About 75% of women reported using the supplement (Table 1).

Table 1. Hemoglobin and hematocrit values

Variable	Type of delivery			p-value**		
	Spontaneous delivery with episiotomy (SD)	Spontaneous delivery without episiotomy (SD)	Forceps delivery with episiotomy (SD)	Forceps delivery vs spontaneous delivery with episiotomy	Forceps delivery vs spontaneous delivery without episiotomy	Spontaneous delivery with episiotomy vs spontaneous delivery without episiotomy
Hemoglobin (g/dl)						
Admission	12.7(0.87)	12.6 (0.90)	13.1 (0.78)	0.0046*	0.0004*	0.3098
Hospital discharge	10.1(1.19)	10.9 (1.27)	10.0 (1.02)	0.5822	<0.0001*	<0.0001*
Postpartum visit	12.2(0.88)	12.5 (0.90)	12.4 (0.67)	0.1503	0.3957	0.0038*
Hematocrit (%)						
Admission	39.2(2.98)	38.9 (3.14)	40.5 (2.64)	0.0034*	0.0006*	0.4496
Hospital discharge	30.6(3.66)	33.0 (3.90)	30.4 (3.09)	0.7336	<0.0001*	<0.0001*
Postpartum visit	37.3(3.01)	38.5 (3.03)	37.9 (2.36)	0.1486	0.2261	0.0008*

At admission for delivery, hemoglobin values ranged from 9.9 g/dl to 15.6 g/dl and hematocrit, from 30% to 49%.

Three groups of women had the same hematologic measures at admission with regard to the mean of these ranges; however, women who underwent forceps delivery had significantly higher hematologic values.

At hospital discharge, hemoglobin and hematocrit ranged from 6 g/dl to 13.9 g/dl and 20% to 43%, respectively. In the same period, mean hemoglobin and hematocrit values in women who had delivery without episiotomy were significantly higher than in those having other types of delivery.

At the postpartum return visit, hemoglobin values ranged between 7.9 g/dl and 14.8 g/dl and hematocrit, between 24% and 44%. Mean hematocrit values at the postpartum return visit for the spontaneous delivery without episiotomy group were sig-

nificantly higher than for the spontaneous delivery with episiotomy group (Table 2).

Hemoglobin values between hospital discharge and admission for delivery ranged from -5.9 g/dl to 0.7 g/dl.

Hemoglobin reduction was significantly greater with forceps delivery than with spontaneous deliveries, with or without episiotomy ($p=0.0133$ and $p<0.0001$, respectively). This fact suggested that forceps delivery caused greater blood loss. Hemoglobin reduction in the group with spontaneous delivery without episiotomy was significantly lower than in the spontaneous delivery with episiotomy group ($p<0.0001$).

Individual differences in hemoglobin values between the postpartum return visit and hospital discharge ranged from 1.3 g/dl to 5.5 g/dl. Recovery of hemoglobin levels at spontaneous delivery without

Table 2. Mean variation and hemoglobin standard deviation

Variable	Type of delivery			p-value**		
	Spontaneous delivery with episiotomy (SD)	Spontaneous delivery without episiotomy (SD)	Forceps delivery (SD)	Forceps vs spontaneous delivery with episiotomy	Forceps vs spontaneous delivery without episiotomy	Spontaneous delivery with episiotomy vs spontaneous delivery without episiotomy
Hemoglobin (g/dl)						
Hospital admission and discharge	-2.6 (1.25)	-1.8 (1.27)	-3.1 (1.24)	0.0133*	<0.0001*	<0.0001*
Postpartum visit and hospital discharge	2.1 (1.08)	1.6 (1.02)	2.3 (0.85)	0.0647	<0.0001*	0.0008*

SD – standard deviation; ** Student's t-test; * statistically significant difference

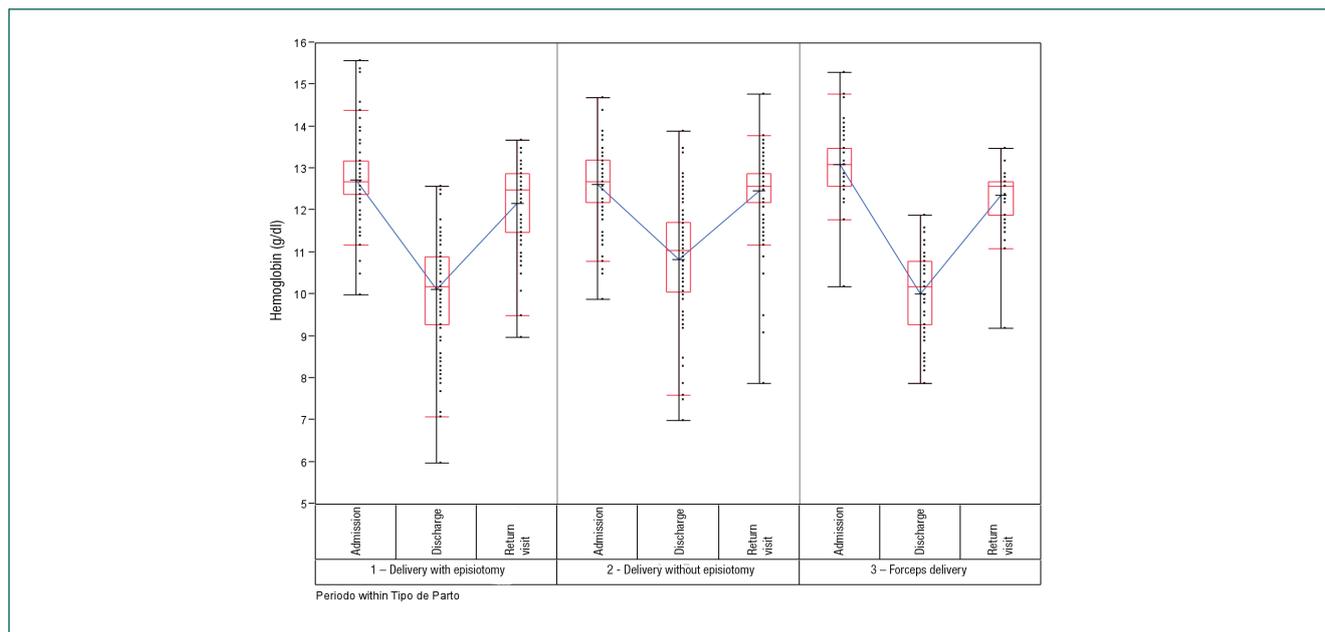


Figure 1. Mean hemoglobin values

episiotomy was significantly lower between these two phases compared with other types of delivery. However, this level is compatible with the reduction between hospital discharge and admission. The range in the forceps group was greater than in the spontaneous delivery with episiotomy group, but the difference was not significant.

In the forceps delivery group, hemorrhage was greater than in the other groups. Hematologic parameters at admission for delivery seemed to influence recovery of these values, almost achieving values seen in the pre-delivery period (Figure 1).

Discussion

In healthy women living in developed countries, blood loss up to 1,000 ml can be considered physiologic, not requiring other treatment beside oxytocic drugs. In developing countries, where anemia prevalence is high, volumes of blood loss less than 1,000 ml can change a woman's vital functions.

Risk of death by hemorrhage after delivery increases when anemia is present; therefore, nonanemic women can tolerate blood loss, but in anemic women blood loss can be fatal.

Our results showed a variation of hemoglobin and hematocrit values between admission for de-

livery and hospital discharge and between hospital discharge and postpartum return visit, for each type of delivery studied.

We also observed that spontaneous delivery with episiotomy and forceps delivery caused a greater effect on blood loss, as evidenced by hemoglobin variation. This effect was smaller in women having spontaneous delivery without episiotomy.

In our analysis of the effect of spontaneous delivery with episiotomy, we found significantly greater blood loss than in women with spontaneous delivery without episiotomy. This result is similar to those in other studies that evaluated the use of episiotomy in women who underwent spontaneous vaginal delivery with one fetus and verified that episiotomy was associated with greater blood loss.^(12,13)

A study carried out in two teaching hospitals in Finland reported that in both primiparous and multiparous women, blood loss between 500 and 1,000 ml occurred more often in the delivery with episiotomy group than in the delivery without episiotomy group. This loss was associated with use of incision in multiparous women, with a statistically significant difference ($p \leq 0.001$).⁽¹⁴⁾

An investigation conducted in Germany compared two proposals of episiotomy use in primip-

arous women who underwent spontaneous vaginal delivery and vacuum extraction delivery: (1) restricted use (only for fetal indication) and (2) liberal use (both fetal indication and eminent perineal laceration); the study found no difference in hemoglobin variation between the pre and postpartum periods between women managed according to either of the two proposals.⁽¹⁵⁾

Episiotomy and perineal trauma repair are the two surgical procedures most conducted by obstetricians. In Brazil the episiotomy rate is 71.6%, although current efforts aim to reduce it to 10%.

Another study revealed higher hematocrit variation in forceps delivery versus spontaneous delivery: $7.9\% \pm 5.10\%$ and $4.3\% \pm .78\%$, respectively; those results confirm our findings.⁽¹⁶⁾

A retrospective study in Finland showed that mean blood loss in women undergoing forceps delivery was 418 ± 248 ml, evaluated by a combination of direct mean volume of blood and gravimetric technique.⁽¹⁷⁾ The loss was similar to the 405.6 ml found by using the colorimetric technique of hemoglobin dilution. That study also reported that blood loss during delivery without episiotomy was lower than during delivery with episiotomy: volumes of 196.5 ml and 327.0 ml, respectively.⁽¹⁸⁾

Our study found that blood loss was significantly greater with forceps delivery than with spontaneous deliveries with and without episiotomy; a result that agrees with other studies.⁽¹⁶⁾

A study in India compared blood loss among women who had spontaneous deliveries using vacuum extraction or forceps by use of hemoglobin variation measured between pre- and postpartum periods; the researchers reported that the mean blood loss estimated in women who underwent vacuum extraction was less than in women who underwent forceps delivery (234 vs 337 ml; $p < 0.05$). However, mean decrease in hemoglobin at admission and the day after delivery was not statistically significantly different between the two groups (vacuum extraction, 0.86 mg/dl; forceps, 1.02 mg/dl).⁽²⁾

Therefore, the studies previously mentioned confirm the evidence that spontaneous delivery with episiotomy and forceps delivery causes greater bleeding. An exception is a study by U.S. researchers

that reported greater blood loss in women having forceps delivery than in those having spontaneous delivery, but no statistically significant difference was found.⁽¹⁹⁾

A randomized pilot study with full-term pregnant women and a single and cephalic fetus compared two proposals for episiotomy in women undergoing instrumental vaginal delivery with vacuum extraction and forceps. One proposal involved routine use of episiotomy for all deliveries and the other involved restricted use only for imminent laceration. These authors did not observe an association between anal sphincter laceration and the proposal for episiotomy use at forceps delivery. However, the study found an increase in hemorrhage after delivery when episiotomy was routinely used at forceps delivery (odds ratio, 1.75; 95% confidence interval, 0.84 to 3.62).⁽²⁰⁾

In our study, laceration was frequent at spontaneous delivery without episiotomy and at forceps delivery, but the difference was not significant. First-degree laceration was significantly more frequent in the spontaneous delivery without episiotomy group. Incidence of second-degree laceration was higher in women undergoing spontaneous delivery with episiotomy and those having forceps delivery, but without a statistical difference. A study conducted in Finland showed that in pregnant women, perineal lacerations and other traumas are associated with episiotomy.⁽¹⁴⁾ In addition, authors also reported that first- and second-degree perineal lacerations and vaginal traumas of the labia minor and urethra occur more frequently without episiotomy both in primiparous and multiparous women.

The use of episiotomy associated with second-degree laceration is questioned because it can be related to reduced hematimetric values in the postpartum period. Some authors verified that hematocrit reduction at delivery with second-degree laceration compared with delivery with midline episiotomy, and also that more extensive vaginal laceration presented greater hematocrit reduction.⁽¹⁶⁾

Considering the effects of delivery type on blood loss and perineal laceration, the importance of measurement of blood loss is evident. Health care professionals must consider the hematimetric parameters of

women before delivery. If hemoglobin and hematocrit parameters at 26 to 28 weeks of gestation are within normal ranges, measurement of these variables can be avoided during hospital stay for delivery care.⁽²¹⁾

This study showed that at the postpartum return visit, hemoglobin and hematocrit indices increased in relation to hospital discharge values without reaching the mean values seen at admission. The indices at the postpartum return visit were significantly higher in women undergoing spontaneous delivery without episiotomy than at delivery with episiotomy.

It is important to emphasize that assessment of blood loss is a crucial part of delivery care. This assessment is as important as other technical care procedures provided to women.

Conclusion

Hemorrhage analysis at vaginal delivery by hemoglobin and hematocrit indices varied among the three types of vaginal delivery assessed. Hemorrhage was greater with forceps delivery and lower with spontaneous vaginal delivery. In cases of forceps delivery, indices during the postpartum period were lower than those observed during hospital stay.

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Collaborations

Gabrielloni MC; Armellini CJ; Barbieri M and Schirmer J contributed to the conception of the project, analysis and interpretation of the data, drafting and critical review of the manuscript to improve its intellectual content and approval of the final version to be published.

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