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Research Article

Prevalence of Postpartum Hemorrhage and Associated Factors. Case and Control Study at the General Hospital of La Huasteca, Hidalgo, Mexico

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Abstract

Background: Postpartum hemorrhage (PPH) continues to be the leading cause of maternal morbidity and mortality worldwide, especially in low- and middle-income countries. It is necessary to identify the associated risk factors.

Materials and Methods: Cross-sectional study in pregnant patients with PPH. Study variables age, marital status, speaker of the Nahuatl language, inadequate prenatal care, body mass index, history of PPH, antepartum anemia, history of arterial hypertension, uterine fibrosis, polyhydramnios, multiparity, multiple pregnancy; labor induction, prolonged labor, macrosomic, tears, type and grade, chorioamnionitis and complications. Descriptive, bivariate and multivariate analysis, X^2 independence test, with a value of $\alpha = 0.05$ of statistical significance.

Results: Frequency of PPH 2.08%, mortality of 20.8 per 1000 r.l.b. Risk factors detected: age ≥ 35 years (OR = 2.25 p = 0.043), antepartum anemia (OR = 9.7 p < 0.05), multiparity (OR = 2.23 p = 0.0291), induction of conduction (OR = 2.9 p = 0.0060), macrosomic (OR = 4.1 p = 0.0050), prolonged labor (OR = 2.6 p = 0.0179), tear (OR = 5.9 p = 0.001), grade II tear (OR = 10.1 p = 0.0049). Group with the highest risk of PPH: 35 - year-old pregnant women with multiparity, antepartum anemia, prolonged labor, undergoing induction and conduction and suffering a grade II tear, probability of 3.6 (p < 0.00000122) times more risk.

Conclusion: The frequency of PPH was low in this series, however mortality was somewhat high. The identified risk factors will be useful for the design of future intervention strategies.

Keywords: *Postpartum Hemorrhage; Delivery Care; Delivery Complications; Hypovolemic Shock*

Background

Postpartum hemorrhage (PPH) remains the leading cause of maternal morbidity and mortality worldwide, it is higher in low- and middle-income countries [1]. It occurs between 5 and 20% of all births and causes 140,000 deaths per year, which is equivalent to one death every 4 minutes [2,3]. Most deaths occur within the first 4 hours postpartum. PPH is the most serious obstetric complication and one of the three leading causes of maternal death (MD) [4] and its incidence has been observed to increase every year in many countries [5]. PPH is defined as blood loss greater than 500 cc in vaginal delivery and more than 1000 cc in cesarean delivery [6] however, this definition has been questioned in recent years. For example, Méndez-Amador [7] points out that any blood loss with the possibility of producing hemodynamic instability should be considered PPH Similarly, the IMSS-162-09 Clinical Practice Guide, 2017 update emphasizes that all obstetric hemorrhage should be considered severe until proven otherwise [8].

This is due to the cardiovascular changes that occur in normal pregnancy, which include: increased cardiac output, arterial compliance, increased extracellular fluid volume, and decreased blood pressure. In addition, venous return and cardiac output increase drastically [9]. These changes in maternal physiology compensate for significant blood loss (in the order of 10 to 15%), which often means that PPH is not diagnosed promptly or be underestimated, since it has been shown that hemodynamic changes in postpartum women alter vital signs (heart rate and systolic blood pressure) up to a loss equal to or greater than 30% [9].

Hence, close monitoring and quantification of blood loss are so important to prevent the development of the "triad of death" as Garrido-Dulcey calls it: "Uncontrolled bleeding generates secondary hypovolemic shock with a loss of blood volume of 40%, hypothermia, coagulopathy and metabolic acidosis" [10]. During postpartum blood loss, it is vitally important to assess the hemodynamic stability of the patient with PPH, for which it has been taken from the pathophysiology of trauma and adapted to obstetrics, Measurement of the Shock Index (SI), which is very simple to measure, is a quotient between the heart rate and the systolic blood pressure [11]. In a retrospective cohort study in patients with postpartum hemorrhage, it was shown that the shock index > 0.9 presents a sensitivity of 100%, and a specificity of 43% (95% CI 36.8 - 50.3) in the prediction of adverse prognosis and admission to the intensive care unit (ICU) [9].

Ye-cheng Liu made a modification of the CI incorporating diastolic blood pressure and has proposed the Modified Shock Index (CMI) measuring heart rate and mean arterial pressure [12]; however, when comparing ICO and ICM, no significant difference was found. In recent years, the measurement of base excess (BE) has been incorporated as a prognostic factor for complications due to hypovolemic shock, which has been very useful for classifying critically ill patients into four groups with different risk of complications in an attempt to improve the classification of patients with hypovolemic shock due to hemorrhage for better intervention and management [13,14].

Despite these efforts and while there is insufficient scientific evidence to evaluate its application in obstetrics, the recommendation of the national and international Clinical Practice Guidelines is the systematic measurement of the SI in all patients during delivery care [8,15]. A An additional problem in relation to the clinical evaluation of the patient with PPH is the estimation of bleeding. This information is very important both to determine the severity of the bleeding and to calculate the replacement of the lost volume. In the vast majority of cases, this is done visually, which underestimates the amount of blood loss between 30 and 50% [16,17]. To avoid this underestimation, more precise methods have been developed to quantify hemorrhage, two of them simple and low cost: the container and calibrated bags and the dry weight of compresses commonly used in delivery care, comparing their wet weight after being used [18,19]. In this way, the evaluation of the loss and the calculation of the replacement volume is more accurate.

Much progress has been made in the diagnosis and treatment of hypovolemic shock in obstetrics; however, a transcendent aspect in childbirth care is to identify the associated risk factors, some of them widely described in the international literature, such as uterine atony [20], tears in the vaginal tissue and/or cervix [21], anemia prepartum [22] (Hemoglobin < 9 g/dL of blood) and in recent times gestational age has been proposed as another risk factor for PPH [23]. Other documented risk factors for PPH are: age of the mother, prolonged labor, macrostomia, history of PPH [24,25], induction of labor [26,27] newborn weight and instrumental delivery [26]. Feduniw [28] has documented uterine fibrosis, arterial hypertension, multiple pregnancy, polyhydramnios, obesity and ethnicity, as other factors

associated with PPH [29] in addition to multiparity, single status and poor prenatal control [30]. Despite this, there is still a limited understanding of the risk factors associated with PPH, especially in vaginal delivery [31].

It is important to remember that in only 30% of cases it is possible to identify risk factors; hence, the indication of the CPG-IMSS-162-09, about blood loss in a vaginal delivery, should be considered as severe until the contrary is proven [8]. The objective of this research was to estimate the frequency of PPH at the Hospital General de la Huasteca (HGH) in a period of five years (2018-2022) and identify the factors associated with it, with the purpose, in a subsequent project, of implementing strategies to change the modifiable risk factors identified in this study.

Materials and Methods

Observational, analytical, retrospective cohort study, of a cross-sectional design with case-control analysis, whose study population was pregnant patients who attended the HGH for delivery care during the period from January 2018 to December 2022 with a diagnosis of PPH, registered in the Statistics area with the ICD-10 codes: O720, O721, O722, O753 (cases) comparing them with patients who attended in the period but without PPH (controls). A sample size of 60 cases with 120 controls (1:2) was calculated, with a reliability of 95%, precision of 5%, and a non-response rate of 15%. The selection of the observation units was made by simple random sampling from the database that exists in the Clinical File area.

The study variables were mother's age, her marital status, if she is a speaker of the Nahuatl language, inadequate prenatal control (< 5 consultations). Body Mass Index (BMI) > 25, with a history of PPH, presence of antepartum anemia (< 9 g/dL of blood), with a history of arterial hypertension, presence of Uterine Fibrosis, polyhydramnios, multiparity (≥ 3 deliveries), pregnancy multiple (more than 1 product); labor induction, if it took place with prolonged labor (> 30 minutes in the 2nd period of labor), if there was a macrosomal product (weight ≥ 4,000g), if the patient presented tears, type of tear, and degree of tear. If she presented uterine atony, chorioamnionitis and whether or not there were complications and what they were, finally the Obstetric Shock Index (OSI) was estimated for each patient and correlated with the degree of shock, likewise, the frequency of PPH was calculated. in the period.

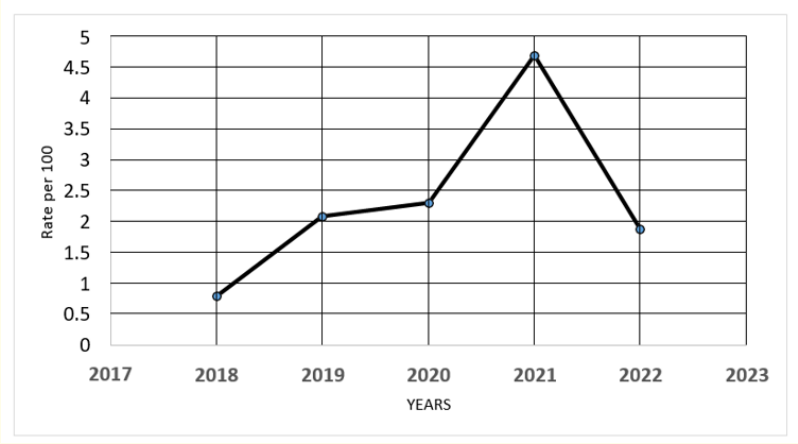
The inclusion criteria were: Having received medical care at HGH during the study period. Have a diagnosis of PPH and registered in the Clinical Record and the Statistics area with the corresponding ICD-10 code. With the information compiled from the files and noted in the data collection instrument, a spreadsheet was designed, verifying during the process that the data was correct. Files with missing or erroneous data were eliminated and there was no replacement. The data capture was carried out in an Excel spreadsheet, Microsoft ver. 2010, which was then exported to the EPI-INF Program ver. 7.0 from the Center for Disease Control, Atlanta, Georgia, United States of America, for statistical analysis.

The statistical analysis consisted of the calculation of simple frequencies, measures of central tendency and dispersion for the numerical variables, rates, ratios and proportions for the categorical variables. The bivariate analysis for categorical variables consisted of calculating X^2, ratio of cross products (OR) with its 95% Confidence Interval (95%CI). In all the tests, the value of $\alpha = 0.05$ was set as the value of statistical significance. The protocol was reviewed and authorized by the Teaching, Research, Training and Ethics Committee of the Hospital.

Results

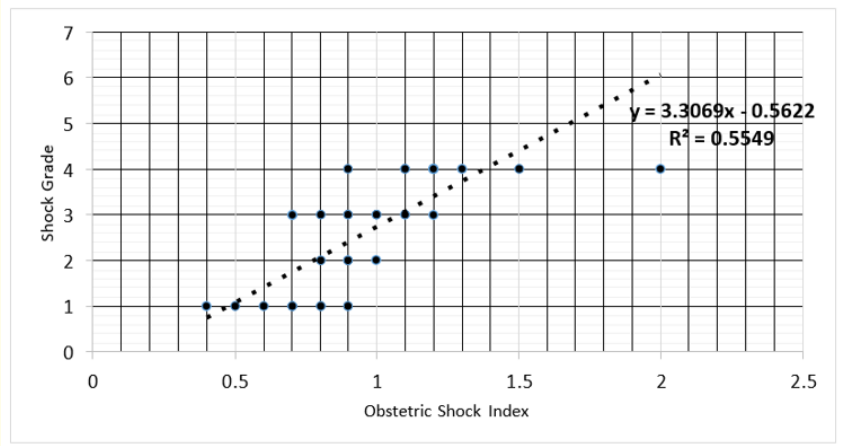
During the study period, 59 cases of PPH were identified, which were compared with 118 non-cases (controls) of PPH, with a 1:2 ratio. Four Clinical Records of the non-cases were eliminated, leaving 114. The frequency of PPH in the period was 2.08% (Graph 1) with a crude mortality rate of 33.3%.

Regarding age, 17.3% (30) were ≥ 35 years old, 17.6% 1 (29) single; almost half, 49.1% (85) women are Nahuatl speakers, a little more than half, 52.1% (90) had inadequate prenatal care. 17.9% (31) patients were overweight and obese, less than 10% (15) of the participants had arterial hypertension. More than a quarter, 27.7% (48), had anemia before delivery; 22.5% (39) had had more than 3 deliveries



Graph 1: *Trend in the prevalence of PPH in HGH. 2018 - 2022.*

and 6.9% (12) patients had induced labor. Almost 10% (17) of the users had a macrosomic child and 16.2% (28) had a prolonged labor. 27.2% (47) presented a tear that in most cases was vaginal 23 (74.2%). Regarding the severity of the tear (Table 1), the most frequent was Grade II with 18 patients (58.1%) of the 31 patients who suffered it. The frequency of uterine atony was 6.7% (4/59 with PPH), chorioamnionitis occurred in 4.6% (8) of the patients. The most frequent complication in the study population was the retention of placental remains with 11.8%. A correlation was made between the severity of the tear and the Obstetric Shock Index, showing a Pearson Correlation Coefficient of 0.5549 (Graph 2).



Graph 2: *Distribution according to severity of the tear. HGH, 2018 - 2022.*

Grade of the tear	NUM.	%
I	3	9.6
II	18	58.1
III	9	29.1
IV	1	3.2
Total	31	100%

Table 1: *Distribution according to severity of the tear. HGH, 2018-2022.*

In relation to risk factors, 16 risk factors were studied, of which 8 were statistical y significant: age ≥ 35 years (OR = 2.25 p = 0.043), anemia before delivery (OR = 9.7 p < 0.05), multiparity (OR = 2.23 p = 0.0291), labor induction (OR = 2.9 p = 0.0060), macrosomal product (OR = 4.1 p = 0.0050), prolonged labor (OR = 2.6 p = 0.0179), at least one tear (OR = 5.9 p = 0.001, and that this was grade II (OR = 10.1 p = 0.0049) (Table 2).

Variable	Cases		Controls		OR	p
	No.	%	No.	%		
Age						
19 - 34*	39	66.1	75	66	0.34	0.036
≥ 35	15	25.4	15	13	2.25	0.043
≤ 18	5	8.5	24	21		
Civil Status						
Married*	20	34	24	21	0.52	0.06
Single woman	39	66	90	79		
Indigenous Status						
No*	27	46	61	54	1.36	0.3400
YES	32	54	53	46		
Antenatal control in appropriate						
Yes*	29	49	54	47	1.07	> 0.05
No	30	51	60	53		
Obesity						
No*	47	80	95	83	1.27	0.5516
Yes	12	20	19	17		
Hypertension						
No*	52	88	106	93	1.78	0.1509
Yes	7	12	8	7		
Gestational Age						
< 38 SDG	8	13.5	24	21	0.60	0.2680
≥ 38 SDG*	49	83.1	90	79		
Anemia						
No*	25	42.4	100	88	9.7	<0.05
Yes	34	57.6	14	12		

Gyneco-Obstetric History						
2-3 deliveries*	12	20.4	33	28	0.78	0.2280
First birth	28	47.4	61	54	2.23	0.0291
Multiparous	19	32.2	20	18		
Labor Induction						
Yes*	7	12	5	4	2.9	0.0060
No	52	88	109	96		
Macrosomal Product						
Yes*	11	18.6	6	5	4.1	0.0050
No	48	81.4	108	95		
Prolonged Labor						
Yes*	15	25.4	13	11	2.6	0.1790
No	44	74.6	101	89		
Tear						
Yes*	30	50.8	17	15	5.9	0.0001
No	29	49.2	97	85		
Tear Severity						
I	2	6.6	9	53	10.1	0.0049
II	18	60	8	47		

Table 2: *Risk factors identified for PPH in HGH, 2018-2022.*

Regarding the multivariate analysis, the group with the highest risk of suffering from PPH in HGH are pregnant women aged 35 years and over, with multiparity, with prepartum anemia, who present prolonged labor, subjected to induction and conduction, and who suffer a grade II tear. they have a probability of 3.6 ($p < 0.00000122$) times greater risk of suffering severe PPH (Table 3).

Variable[1]	%[2]	Risk
Age ≥35 years	17%	OR = 3.6[3] p = 0.00000122
Multiparity ≥ 3 deliveries	23%	
With pre-partum anemia (< 9 g/dL) of blood	28%	
Course with prolonged labor (> 30 minutes in 2nd period)	16%	
Subjected to inductoconduction	7%	
Presents grade II vaginal tear	58%	

Table 3: *Group of patients with the highest risk of suffering PPH in HGH, 2018-2022.*

Note: 1: Variable with statistical significance in the bivariate model ($p < 0.05$). 2: Proportion of the population of HGH users. 3: Risk probability in relation to users who do not have these variables.

Discussion

The reported global PPH frequency ranges from 0.4 to 33%, 3 that found in our series was 33.3% (59/177). However, very high compared to that found by Álvarez-Silveres., *et al*. in our country, of 3.3% [32]. More than double the rate published by Hernández-Morales., *et*

al. in a University Hospital in Northern Mexico of 16% [33] and more than 10 times that reported for countries such as China, 1.5% [24]; Norway, 2.5% [34] and the United States of America, 5% [20]. While the crude mortality rate due to PPH, which in our study was 16.9 per 1,000 nvr. (3/177) was higher than that reported for Asia, 3.08 and Africa, 3.39 [3] and higher than that reported by China, 0.15 [24]; United States of America (USA) 0.522 and Norway, 0.25 per 1,000 nvr, respectively [3,4].

In relation to the risk factors found in our study, these are similar to what has been documented by other authors, although we differ with other reports. Age < 18 years has been documented as a risk factor; however, in our study, the factor associated with PPH was age > 35 years. Anemia before delivery, which in our study had a value of OR = 9.7, is higher than that reported by Stepan Feduniw., *et al*. [3] in Poland, OR = 4.1, and Omotayomo., *et al*. in the USA, OR = 4.22. Because in almost half of the cases, our hospital treats a marginalized indigenous population whose main health problems in the reproductive period, in this case, are poor nutrition in the gestational stage and the low percentage of patients with adequate prenatal care, whose policy public health service is to provide folic acid and iron supplements [35].

Our results coincide with those of Soto., *et al*. [36] in relation to the greater number of deliveries in the patients (multiparity, ≥ 3 deliveries) as a factor associated with a higher probability of PPH. Regarding the labor induction factor, this association coincides with that reported by Ende HB., *et al*. [20] in the USA and Sánchez., *et al*. in Spain [37] similarly, this same author publishes the macrosomic product (≥ 4,000), data coincident with our results. Prolonged labor, in our investigation, turned out to be a risk factor, data similar to that reported by other authors as a risk factor for PPH [30,31,38]. Finally, mainly vaginal and grade II tears, in our series, had a strong association with PPH, which coincides with Zambrano-Villamar., *et al*. in Ecuador.

With the risk factors identified and through the multivariate analysis, the group with the highest risk of PPH, an educational intervention strategy will be designed aimed at the medical and nursing staff who care for the obstetric population with the purpose of contributing to the reduction of the frequency and lethality due to HPP, which will be the reason for a second report [39].

Conclusion

The frequency of PPH was low in this series, however mortality was somewhat high. The identified risk factors will be useful for the design of future intervention strategies.

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