

Original research Articles**Prevalence and Risk Factors of Primary Postpartum Hemorrhage after Vaginal Deliveries in the Bonassama District Hospital, Cameroon.****ABSTRACT**

Background: Approximately 800 women die from pregnancy-related conditions daily with 99% of these maternal deaths occurring in low resource countries. Primary postpartum hemorrhage accounts for 25.7% of maternal deaths in Africa. In Cameroon, primary postpartum hemorrhage remains the leading cause of maternal death.

Objective: The aim of this study was to determine the prevalence, risk factors, and the maternal and fetal outcomes of primary postpartum hemorrhage in the Bonassama District Hospital, Douala, Cameroon.

Methods: This study was a cross-sectional study. Of the 556 women interviewed regarding their willingness to participate in the study, 550 consented. Quantification of blood loss was done over the 24 hours using a 700cc measuring cylinder, an electronic weighing balance and the Pathfinder International wall chart for visual estimation of blood loss. The well-being of the neonates was evaluated by a pediatrician. Data was collected using a structured questionnaire and analyzed using EPI-INFO™ version 7.1.4.0. A P-value <0.05 used to determine association between variables was considered statistically significant.

Results: The prevalence of primary postpartum hemorrhage was 23.6%. The risk factors of primary postpartum hemorrhage were: previous postpartum hemorrhage (aO.R=6.50; 95% C.I=4.60-9.20), multiparity (aO.R=7.02; 95% C.I=5.27-8.02), prolonged labor (aO.R= 1.1; 95% C.I=1.01-6.61) and macrosomia (aO.R=8.18; 95% C.I= 5.53-8.51). The main causes of PPH were uterine atony and obstetrical lacerations (P-value<0.01). Two (1.5%) maternal and 2 (0.4%) perinatal deaths were recorded.

Conclusion: The prevalence of postpartum hemorrhage was high. The main cause of primary postpartum hemorrhage was uterine atony. Primary PPH was associated with uterine hypotonia, placenta retention and genital lacerations. The maternal and perinatal mortality were high.

Recommendations: These findings highlight the pressing need for good quality emergency obstetric care and the availability of more accurate techniques of postpartum blood loss measurement such as the BRASS-V drapes. Secondly, hospitals need blood banks to manage patients with severe hemorrhage.

Key Words: primary, postpartum hemorrhage, maternal, perinatal, death, Cameroon.

List of Abbreviations

AMTSL Active Management of Third Stage of Labor

ANC Antenatal Care

aO.R Adjusted Odds Ratio

44	APH	Antepartum Hemorrhage
45	BDH	Bonassama District Hospital
46	C.I	Confidence Interval
47	CS	Caesarean Section
48	DIC	Disseminated Intravascular Coagulation
49	HGY	Hopital General Yaoundé
50	IRB	Institutional Review Board
51	IUD	Intrauterine Death
52	Mb	Mass of Blood
53	O.R	Odds Ratio
54	PPH	Primary Postpartum Hemorrhage
55	WHO	World Health Organization

56 **1. INTRODUCTION**

57 Worldwide, women of reproductive age die from the complications associated with pregnancy
58 and child birth. More than half of these deaths occur within the first 24 hours following childbirth
59 and are associated with excessive bleeding [1-3].

In Africa, studies have shown that the major causes of maternal death are post-partum (especially primary postpartum) hemorrhage (25.7%), hypertension (14%), Sepsis (11%) and abortions (8%) and other indirect causes (28%) [3, 6].

In Cameroon, the maternal mortality ratio has increased over the recent years, from 690 deaths /100 000 in 2010 to 789 deaths/100 000 live births in 2014 [4]. The main cause of maternal death was hemorrhage (38%) with primary postpartum hemorrhage being the leading cause of death accounting for 4.1% of cases [4]. Studies conducted in the General Hospital and the Yaoundé Central Teaching Hospitals in 2008 and 2013 reported prevalence of primary postpartum hemorrhage of 1.68% and 4.1% respectively [4,5]. Recently, the incidence of primary postpartum hemorrhage in the Yaoundé Central Teaching Hospital was reported at 13.9% in 2014 [7]. This indicates that the prevalence of primary postpartum hemorrhage has significantly increased over the past years.

According to World Health Organization, of the 275,000 women who die every year from pregnancy and childbirth, one-quarter of these deaths are due to primary postpartum hemorrhage. As such, primary postpartum hemorrhage remains a major health issue because the majority of maternal deaths (88%) occur within four hours of delivery despite all the progress made in the active management of the third stage of labor (AMTSL) [8].

It is important to know the circumstances under which hemorrhage occurs and the risk factors associated with it [3]. The risk of dying from PPH depends not only on the amount and rate of blood loss, but also the health status of the woman. Poverty, lifestyle and malnutrition are some of the broad issues that have unfortunately come to be accepted as inevitable and unchangeable but which influence the outcome of a patient with PPH [9]. The reality about PPH is that two-thirds of the women who experience it have no identifiable risk factors such as multiple births or fibroids [10]. The aim of this

study was to determine the prevalence, risk factors, and maternal and fetal outcomes of primary postpartum hemorrhage in the Bonassama District Hospital (BDH), Cameroon.

METHODS

2.1 Study Setting

This cross-sectional analytic study was carried out in the Maternity unit of the Bonassama District Hospital from 1st December 2014 to 15th April 2015. The Bonassama District Hospital is one of seven health districts hospitals that serves the cosmopolitan town of Douala with a population of 1,088,026 inhabitants [11].

The BDH is located in Bonassama Health District which is one of the thirty health districts in Littoral Region, Cameroon. The hospital was chosen because it offers obstetrics and gynecological services to the population. It has a surgical theatre, a blood bank and attends to women of all social classes. An average of 1790 deliveries is carried out in the maternity annually. The hospital has eight general practitioners and nine specialists including a gynecologist. The personnel of the maternity of BDH during the period of study was made up of a gynecologist, eight midwives, three student midwives and six paramedical personnel. The paramedical personnel are not trained in providing obstetric care but are responsible for the cleanliness of the wards, taking samples and collecting results from the laboratory.

2.2 Sample Size Calculation

The sample size was calculated using the formula for comparing two proportions [12]. For a confidence level of 95%, $Z_{crit} = 1.96$, Z_{pwr} = standard normal deviate for the desired statistical power of

80% = 0.80 The pre-study prevalence of adverse outcome of primary PPH was estimated at 13.4 % [6] while the pre-study estimate of the prevalence of PPH in naïve parturient with no risk factors in Cameroon was 50 % [6]. A minimum sample size of 456 pregnant women was required for the study. However, five hundred and fifty parturients were enrolled to make our results more justifiable.

2.3 Data Collection

For each potential participant, after self-introduction by principal investigator or research assistant, the study was carefully explained to the participant, with emphasis on the importance, risks and benefits associated with participating in the study. Furthermore, the choice of participating was voluntary after the briefing. A convenient sampling procedure was used to select all participants who met the inclusion criteria (pregnant women who delivered at BDH, were >28 weeks and had a vaginal delivery). Those referred from other maternities with PPH were excluded. During the study period, 556 women were interviewed but only 550 were enrolled. The others declined for personal reasons.

Management of Patients with Primary PPH

General Measures

The third stage of labor was actively managed in all the participants. Uterine massage, which is part of active management of the third stage of labor (AMTSL) was systematically performed on all the women over a period of 30 minutes to 1 hour in order to avoid uterine atony. The participants who had symptoms and signs of cardiovascular decompensation were initially resuscitated with crystalloids or colloids.

Specific Measures

Uterine evacuations were performed in cases of PPH due retention of placenta debris. This procedure was performed either by a midwife or a gynecologist. Conservative management involved the

administration of a utero-tonic. Other surgical interventions like the repair of genital lacerations were carried out depending on the extent of the lesions with absorbable sutures. All the 550 participants were prescribed hematinic. Furthermore, all the patients who had a uterine evacuation or obstetrical lacerations were administered antibiotics in order to prevent sepsis.

Diagnosis of Primary PPH

Immediately after the cord was clamped and sectioned, the blood collection was started by putting a bed pan under the buttocks of the woman. Blood collection and measurement continued until cessation of the third stage of the labor. The parturient was subsequently transferred to the postnatal ward after surveillance for about an hour. Three main steps were involved in the quantification of blood loss immediately after delivery and within 24 hours following delivery.

a) Measuring the Mass of Blood (m_b) Lost:

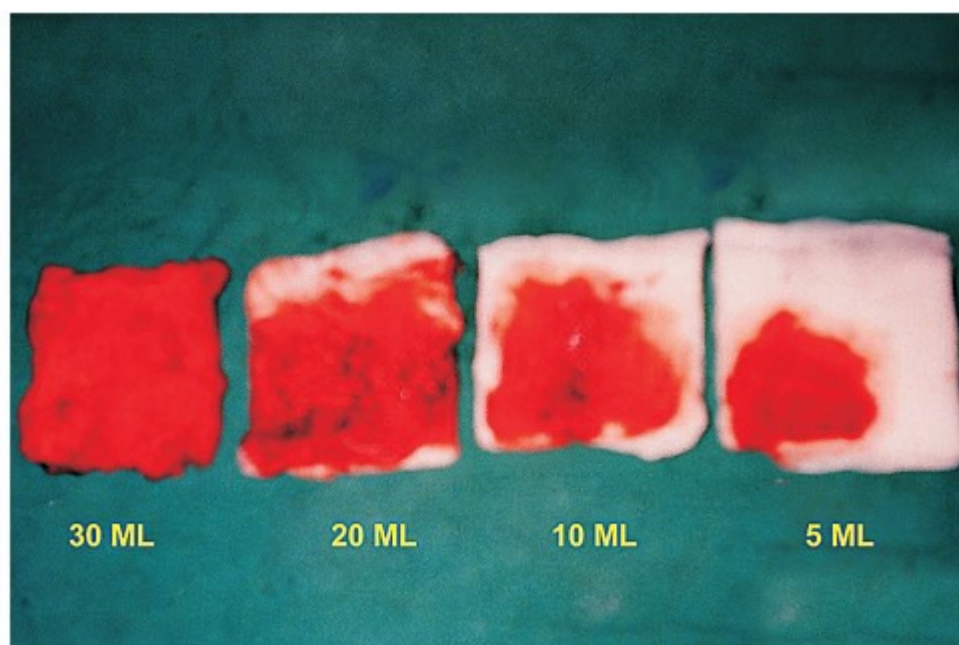
Firstly, it was ensured that the weighing units of our electronic machine were displayed and the weighing machine was calibrated. An empty jar was weighed, blood collected from the bed pan was subsequently poured into it, and it was reweighed. The mass of blood loss (m_b) was the difference between the two weights.

b) Calculating the volume of blood lost during the third stage and within one hour after delivery (V_1):

The volume of blood lost from our direct measurements was calculated using the formula:

$V_1 (m^3) = m_b (Kg)/\rho (Kg/m^3)$; where: ρ = density of blood ($1,060kg/m^3$) [13]. The blood lost by the participants while in the ward (V_2) was quantified using the visual estimation of blood loss by the

145 Pathfinder International wall chart



146 [14]

147 **Figure 1: Soakage characteristics of 10X10cm gauze (Adapted from: B-Lynch et al., 2006, page 43)**

148 [14]

149 The participants had their sanitary pads on during the first 24hours and the visual estimation was
150 done before they changed their pads or beddings.

151 c) The total blood lost (V_T) was calculated by adding the intra-partum blood loss to that obtained
152 from visual estimation. That is, $V_T = V_1 + V_2$.

153 The participants were also examined for symptoms and signs of cardiovascular decompensation
154 and for possible causes of primary PPH. The diagnosis of PPH was based on a vaginal blood loss
155 of ≥ 500 cc within the first 24 hours after delivery.

156 The parameters of neonates; birth weight and Apgar score were obtained after the first, fifth and
157 tenth minutes of life. Those whose conditions were unsatisfactory were reevaluated by the

158 pediatrician. Neonates with APGAR scores $<7/10$ after the fifth minute were transferred to the
159 neonatology unit for further management.

160 **2.4 Data Management**

161 A pretested questionnaire was used to record data on socio-demographic variables, risk factors of
162 PPH (previous caesarean section, past history of PPH, pregnancy induced hypertension, HIV
163 etc.), obstetric history (parity, polyhydramnios, uterine over-distension, duration of labor etc.)
164 from the medical records, and fetal and maternal outcomes.

165 Data entered was doubled checked for errors. It was cleansed and saved in the hard drive of the
166 computer as a back-up, transcribed into Epi InfoTM 7.1.4.0 software and analyzed. In describing
167 the socio-demographic and obstetric characteristics, measures of central tendencies (means and
168 medians) were used. For categorical data, frequencies were computed. Chi-squared or Fisher's
169 tests were used to compare proportions where appropriate to determine the strength of association
170 between variables. The odds ratio of patients with PPH and risk factors compared with those
171 without risk factors was also determined. A multiple logistic regression analysis controlling for
172 confounding factors was also done. Risk factors were significantly associated with PPH if P-
173 value <0.05 .

174 **2.5 Limitation of Study**

175 Some of the patients did not allow their used sanitary pads to be assessed subsequently in order
176 to quantify the blood loss within the first 24 hours. This probably resulted in an under estimation
177 of the post-partum blood loss in some cases. This error was minimized by reiterating to the
178 participants the aim of this study and how their contribution will actually improve on patient care.
179 Furthermore, direct quantification of the amount of blood loss during a vaginal delivery might not

180 be accurate because we ignored the maternal blood in the placenta and the blood lost while
 181 transferring blood from the bed pan into the measuring cylinders. This was minimized by
 182 calculating the volume of blood lost in the form of clots using the density of blood. Though the
 183 results of the study cannot be generalized to what obtains in other regions, because of the small
 184 sample size, they however, partially reflect the picture of primary PPH in a typical health district
 185 hospital in Cameroon.

186 **RESULTS**

187 **3.1 Prevalence of Primary Post- Partum Hemorrhage**

188 During this study period, 130 (23.6%) cases of primary postpartum hemorrhage were diagnosed.

189 **3.2 Socio-Demographic Characteristics the Study Population**

190 The mean age of the 130 participants with primary postpartum hemorrhage was 24.5 (SD 4.6)
 191 years. The majority of the women 111 (85.4%) who had primary PPH were between 20-30 years.
 192 Most of the women who had PPH were self-employed 93 (71.5%). They were mainly traders,
 193 hair-dressers and business women. Although the occupation of the patient was significantly
 194 associated with primary PPH (P-value<0.05), it was not a risk factor for PPH after controlling for
 195 confounders. Other socio demographic characteristics are shown in Table 1.

196 **Table I: Socio-Demographic Characteristics of the 130 Participants with Primary PPH**

Characteristic	PPH	No PPH	P-value
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	n=130 (%)	n=420 (%)	
Age (years)			
<20	11 (8.5)	55 (13.1)	0.689
20-30	111 (85.4)	337 (80.2)	
>30	8 (6.2)	18 (8.2)	
Occupation			
Unemployed	27 (20.8)	16 (7.3)	0.001
Self-employed	93 (71.5)	390 (92.9)	
Employed	10 (7.7)	14 (6.4)	
Marital status			
Married	25 (19.2)	25 (19.2)	0.586
Single	105 (80.8)	105 (80.8)	
Educational level			
Primary	18 (14)	15 (6.8)	0.074
Secondary	94 (72.3)	363 (86.4)	
Tertiary	18 (14)	42 (19.1)	

197

198 3.3 Clinical (medical, surgical and gynecological) Characteristics

199

200 Based on the past medical history, 5 (3.9%) participants had chronic hypertension, 8 (6.2%) HIV and 3
 201 (2.3%) had other medical conditions like asthma. Of the 130 women who had primary PPH, 13 (10%)
 202 had malaria during pregnancy. This was significantly associated with PPH (P-value<0.05). Those who
 203 had malaria during pregnancy were 6 times more likely to develop primary PPH than those women

204 who did not. Pregnancy induced hypertension (PIH) accounted for 5 (3.9%) of the cases of PPH while
 205 9 (6.9%) were associated with premature of membranes. Unlike malaria, these were not significantly
 206 associated with primary PPH. The risk of primary PPH was higher in patients with a history of
 207 abortion, myomectomy and post- partum hemorrhage (P-values <0.05)

208 **Table 11: Multi-Variate Analysis of the Past Clinical History of the 130 Participants with**
 209 **Primary PPH**

Past History	PPH (n=130) (%)	No PPH (n=420) (%)	P-value	O.R	aO.R	95% C.I
Surgical						
None	106 (81.5)	403 (96)	0.022	-	-	-
Cesarean section	8 (6.2)	7 (3.2)		2.19	1.25	0.29-5.43
Dilatation & Curettage	8 (6.2)	6 (2.7)		2.55	0.49	0.04-5.43
Myomectomy	8 (6.2)	4 (1.8)		3.83	1.29	0.15-11.26
Gynecological						
None	102 (78.5)	403 (96)	0.002	-	-	-
Previous abortion	16 (12.3)	10 (2.4)		3.18	1.22	7.00-10.30
Genito-urinary infections	5 (3.8)	4 (1)		1.59	1.47	1.24-8.88

Previous PPH 7 (5.4) 2 (0.5) 6.97 6.50 4.60-9.20

210

211 As shown in Table III, participants' gravidity and parity were both significantly associated with
 212 primary PPH. Grand multigravidas were 12 times more likely to develop PPH than primigravidas,
 213 however using multiple logistic regression adjusting for confounding factors, their risk dropped
 214 (O.R=2.64; aO.R= 4.59; 95% C.I=3.79-8.46). Furthermore, multiparous women were 7 times more
 215 likely to develop PPH than primiparous women (OR=6.45; aO.R=7.01, 95%CI=5.27-8.02) using
 216 multiple logistic regression adjusting for confounding factors.

217 **Table III: Bi-Variate Analysis of the Obstetric Characteristics of Participants with Primary**
 218 **PPH.**

Pregnancy	PPH (n=130)%	No PPH (n=420)%	P-value	O.R	aO.R	95% C.I
Primigravida	9 (6.9)	85 (20.2)	0.001	-	-	-
Multigravida	108 (83.1)	281 (66.9)		1.36	0.20	0.01-3.84
Grand Multigravida	13 (10)	54. (12.9)		2.64	4.59	3.79-8.46
Parity						
Primiparous	19 (14.6)	77 (18.3)		2.72	3.88	1.59- 5.79
Multiparous	106 (81.5)	341 (81.2)		6.45	7.01	5.27-8.02
Grand multiparous	5 (3.8)	2 (0.5)		2.5	3.73	1.61-7.16

219

3.4 Socio – Obstetrics Characteristics of the Current Pregnancy

Antenatal Care Attendance (ANC) and Gestational Age

Fourteen (2.6%) women did not attend ANC. Furthermore, only 169 (30.7%) participants had the minimum of 4 ANC visits as recommended by World Health Organization. Eight (6.2%) women who did not attend ANC had PPH but there was no significant association between the number of ANC attendance and primary PPH (P value= 0.26). Of the 480 (87.3%) term pregnancies, 121 (93.1%) had PPH, while 6 (4.6%) developed PPH of the 36 (6.6%) that were post-term. There was no significant association between primary PPH and gestational age. .

Causes of Uterine Over - Distension

As shown in Table IV, the causes of large for dates uterus or uterine over distension based on the ultra-sonographic findings during pregnancy were; multiple pregnancy, hydramnios, uterine fibroids and macrosomia. There were 10 (1.8%) cases of multiple gestations; six (4.6%) of them developed PPH. Furthermore, out of the eight cases of uterine over-distension due macrosomia, 5 (3.8 %) developed PPH. There was no significant association between these variables and primary PPH.

Table IV: Causes of Uterine Over-Distension among Participants

Causes of uterine over distension	PPH (n=130)	No PPH (n=420)	P-value
None	114 (87.7)	410 (97.6)	0.13
Multiple pregnancy	6 (4.6)	4 (1)	
Macrosomia	5 (3.9)	3 (0.7)	
Hydramnios	3 (2.3)	2 (0.5)	

Uterine fibroids	2 (1.5)	1 (0.2)
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236

237 **3.5 Labor and child birth**

238 *Induction of Labor*

239 Of the 550 women who gave birth at the BDH, 10 (1.8%) had induced labor indicated for post-term or
 240 premature rupture of membranes (PROM). Among these 10 women, 7 (70%) developed PPH. After
 241 multiple logistic regression analysis adjusting for confounding factors, women who had an induced
 242 labor were 4 times more likely to develop PPH than those who were not induced (O.R=4.12; aO.R
 243 4.02; 95% C.I=3.2 -11.09).

244 *Duration of Labor*

245 As shown in Table V, of the 218 (39.64%) women who delivered within 12 hours, 12 (9.2%)
 246 developed PPH, with the extremes of the duration of labor ranging between 2 and 26 hours. Prolonged
 247 labor was associated with PPH, participants whose labor lasted more than 24 hours having a higher
 248 risk of developing PPH than when labor lasted less than 12 hours.

249 **Table V: Relationship between Duration of Labor and PPH**

Time (hrs)	PPH (n=130)(%)	No PPH (n=420)(%)	P-value	O.R	aO.R	95% C.I
<12	12 (9.2)	206 (49.1)	0.003	0.11	0.08	0.29-5.43
12-24	104 (80)	208 (49.5)		0.25	1.29	1.05-1.45
>24	12 (10.8)	6 (1.4)		1.17	1.10	1.01-6.61

250 *Qualification of the birth attendant*

One hundred and twenty three (94.9%) of the 130 deliveries that resulted in PPH were carried out by midwives compared to 2 (3.7%) deliveries conducted by the gynecologist. The cases of labor conducted by the gynecologist included breech presentations and locked twins, conditions that are usually associated with genital trauma. There was a significant association between primary PPH and the qualification of the birth attendant (P value=0.0001).

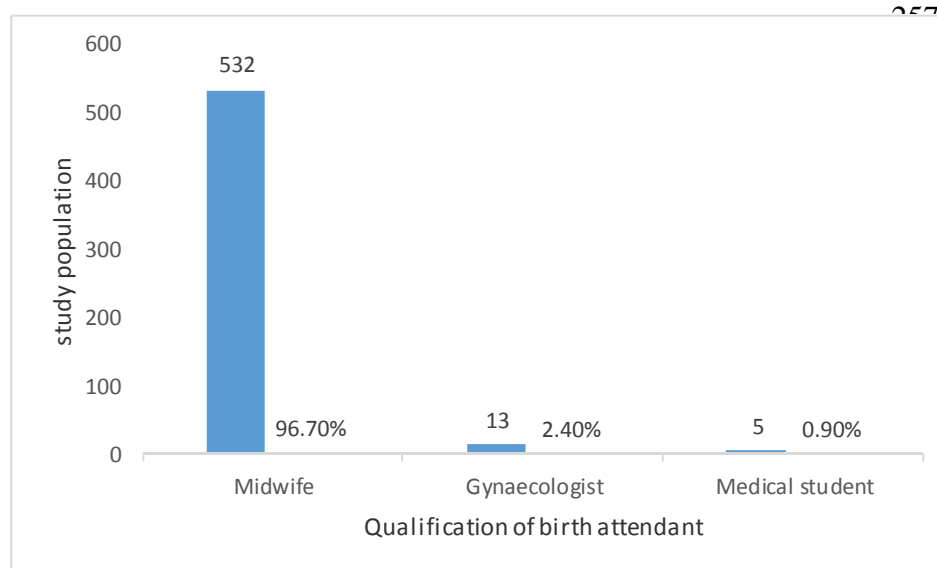


Figure II: Qualification of Birth Attendant

Multiple Pregnancies, Birth Weight and PPH

Of the eight (1.5%) women who had twin deliveries, 4 (50%) were diagnosed of PPH but there was no significant association between PPH and multiple pregnancy (P-value= 0.45). Unlike preterm delivery which occurred in 18 (4.3%) women without primary PPH, 10 (7.7%) participants who gave birth to macrosomic babies were predisposed to PPH (P-value= 0.02) (Table VI).

Table VI: Relationship between Birth Weight and PPH

Birth weight (g)	PPH (n=130)(%)	No PPH (n=420)(%)	P-value	O.R	aO.R	95% C.I
<2500	0	18 (4.3)	0.02	-	-	-
3000-4000	120 (92.3)	364 (86.7)		1.68	1.47	0.14-15.65
>4000	10 (7.7)	38 (9.0)		9	8.28	5.3- 8.51

267

268 Of the 558 neonates delivered in BDH, there were 2 (0.4%) perinatal deaths; a still birth and a neonatal
 269 death from neonatal asphyxia.

270 3.6 Etiological Factors of Primary Postpartum Hemorrhage

271 As shown in Table VII, the causes of primary PPH in BDH were uterine atony due to placenta
 272 retention 81 (62.3%) and obstetrical lacerations 49 (37.7%) . Among the women who had
 273 genital trauma, 25 (51.0%) were due to cervical lacerations, 15 (30.6%) perineal tears and 9
 274 (18.4%) vaginal tears.

275 **Table VII: Etiologies of Primary PPH and Risk Factors**

Etiology	Risk Factors	O.R	aO.R	95% C.I
	Previous myomectomy	3.83	1.29	1.05-4.26
	Previous PPH	6.97	6.50	4.60-9.20
	Malaria in pregnancy	6	7.29	1.83-8.47
	Previous genito-urinary	1.59	1.47	1.24-8.80

Uterine atony	infections			
	Multiparity	6.45	7.01	5.27-8.02
	Prolonged labor	1.17	1.10	1.0-6.61
	Macrosomia	9	8.28	5.30-8.51
Genital trauma	Precipitated labor	2.09	1.89	1.07- 3.56

276

277 3.7 Maternal and Neonatal Outcomes of Patients with Primary PPH

278 One hundred and four (95.4%) women diagnosed of PPH were administered 1-1.5 liters of Ringer
 279 Lactate or 0.9% normal saline because of mild hypotension while 6 (4.6%) participants were clinically
 280 stable. Colloids were only administered to 17 (13.1%) women who presented with moderate to severe
 281 primary PPH. Forty-seven (33.8 %) participants had uterine evacuations, 40 (30.8%) because of
 282 retention of placenta debris. Conservative management involved the administration of a utero-tonic.
 283 One hundred and thirty-five (24.6%) women without underlying co-morbidity were administered an
 284 infusion of oxytocin flowing at 10IU/h for 4hours and then re-evaluated. Twelve (9.2%) patients, who
 285 did not respond to the first line of treatment with intravenous oxytocin, were administered 500mcg of
 286 Ergometrine intramuscularly. Twenty one (16.2%) participants were administered 800mcg of
 287 misoprostol rectally.

288 Among the 49 (37.7%) participants who had obstetrical lacerations, 40 (7.3%) had lacerations of the
 289 genital tract which were sutured. No hysterectomy was performed for primary PPH.

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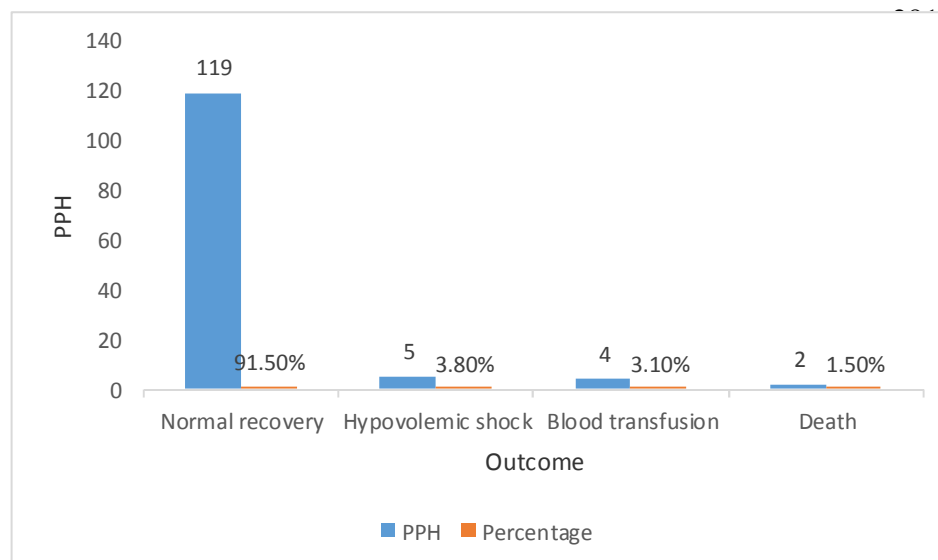


Figure 3: Relationship between maternal outcome and PPH.

Of the 130 (23.6%) cases of PPH, 4 (3.1%) were transfused whole blood while 2 (1.5%) women died from uncontrolled bleeding during referral to a tertiary center.

Neonatal outcomes were; uneventful deliveries, a still birth and a neonatal death. The case of birth asphyxia was due to prolonged labor.

4. DISCUSSION

The aim of this study was to determine the prevalence, risk factors, and the maternal and neonatal outcomes of primary PPH in the BDH, Cameroon.

4.1 Prevalence of Primary PPH

The prevalence of primary PPH of 23.6 % is higher than the 4.1% reported by Tebeu and colleagues in Yaoundé [4]. This shows that there has been a significant increase in the prevalence of postpartum hemorrhage in some hospitals in Cameroon. This also reflected by the significant rise in the maternal

mortality ratio from 690 to 782 deaths /100 000 from 2006 to 2010 with PPH being the leading cause of maternal mortality [3]. The prevalence of Primary PPH in this study was comparable to the 25.7% reported by Calvert et al [5] in Africa, but higher than the 21.5% and 14.3% reported in East Africa and Northern Nigeria respectively [15, 16]. However, lower values were reported by some researchers in West Africa in similar studies [17]. This difference in the prevalence of PPH is probably due to the methods used in estimating blood loss after delivery and the setting of these studies. Prasertcharoensuk reported that visual evaluation of blood loss could lead to an underestimation postpartum blood loss by 89% [18]. The clinical importance of this underestimation cannot be overemphasized as it could explain why PPH is still associated with a high maternal morbidity and mortality worldwide because of late intervention strategies [18].

4.2 Aetiologies of PPH and Risk Factors

Uterine Atony

Uterine atony was the most common cause of PPH in 81 (62.5%) cases. This value was lower than the 70% reported by Anderson *et al.* [19] but higher than that of Sango *et al* in HGY where uterine atony accounted for 51.06 % of cases of primary PPH. On the other hand, our result was comparable to the 60.7% obtained by Coulibaly in Mali [20]. Uterine atony remains a major public health issue as it is the main cause of primary postpartum hemorrhage. The risk factors associated with uterine atony were: previous (myomectomy, PPH, abortion), multiparity, malaria in pregnancy, induced labor, prolonged labor and macrosomia as documented in other studies [4,5,6,7].

Past Surgical and Medical Conditions

The number of cases of previous caesarean sections (6.2%), dilatation and curettage (6.5%), and myomectomies (6.5%) were similar to the 6.5% in Maiga *et al* series [21] and Henri in CHUY,

Cameroon [7]. A history of abortions (12.4%), PPH (5.43%) and genital infections (3.9%) was significantly related to postpartum haemorrhage as reported by Tebeu et al [4] and Henri et al [7]. There was no significant association between PPH and advanced maternal age, polyhydramnios, HIV, PIH, post term pregnancy and multiple gestations. Furthermore, polyhydramnios was not associated with PPH which contrasted the findings of the study conducted in a tertiary hospital in Pakistan by Anderson [19]. He suggested that, this could have resulted from the increased incidence of polyhydramnios and increased birth weight in pregnancies complicated by gestational diabetes. Uterine surgeries such myomectomies were risk factors for PPH because a scarred uterus forms a background for placental tissue adherence which led to placenta retention and subsequently atony [22].

In this study, of the 130 cases of PPH, 13 (12.9%) women presented with uterine atony and retained placenta. This was lower than the 21.3% obtained by Adelusi *et al* in Scandinavia [23].

Trauma

Obstetrical lacerations were the primary cause of PPH in 37.7 % of cases as compared to 20% in Anderson et al study [19]. This is because the age related changes in the connective tissue decrease the ability of cervical, vaginal and perineal muscles to stretch as needed during delivery resulting in greater trauma to tissues, prolonged labor and diminished uterine contractility after delivery [24]. Genital tract trauma at delivery was associated with an O.R 1.7 (95% C.I 1.4-2.1) for blood loss >1000ml [6]. Similar results were found in a Dutch study with a reported O.R of 1.82 (95% C.I 1.01-3.28) for PPH (>1000ml) with perineal tears (second and third degree tears) being the most common cause [25]. Trauma to the broad ligament, uterine rupture, cervical and vaginal tears and perineal tears are all associated with an increased blood loss at normal vaginal delivery. The first cause of obstetric hemorrhage was cervical tears 25 (51.0%) followed by perineal tears 15 (10.6%). This result was

higher than the 21.5% and 18.6% of cervical and perineal tears respectively reported in a health district in Mali in 2006 [20]. No case of episiotomy was associated with primary PPH in this study population. The risk factors for obstetric laceration were precipitate labor and macrosomia or neonates babies presenting with congenital malformations such as hydrocephalus. However, women who gave birth to fetuses with birth weight less than 2500g were less prone to having primary PPH.

4.3 Maternal and Neonatal Outcomes

Of the 130 participants who were diagnosed with primary PPH, 119 (91.5%) had a normal recovery. Five (3.8%) had hypovolemic shock, 4 (3.1%) were transfused whole blood and 2 (1.5%) died from uncontrolled bleeding during referral to a tertiary center. The prevalence of hypovolemic shock due to severe PPH was lower than the 7.1 % reported by Sango in Hopital General Yaoundé, (HGY) [22]. Death probably resulted from the delay in blood transfusion because of the difficulty in obtaining compatible blood since the blood bank had limited reserves or from disseminated intravascular coagulopathy due to consumption of clotting factors as reported by Sango [22]. The 1.5% maternal death recorded in this study is high and doubles the 0.7% reported by Sango in HGY [22] because the latter study was carried out in a tertiary center with better facilities and trained personnel. Other reasons which could account for the high mortality in this study were; late referral, insufficient blood reserves in the blood bank and the poor conditions under which the patients were transported during referral.

Neonatal outcomes were mostly uneventful although a stillbirth and early neonatal death due to birth asphyxia occurred.

5. CONCLUSION

The prevalence of primary postpartum hemorrhage in Bonassama District Hospital was high. It was a major cause of maternal and neonatal morbidity, and mortality. Though the occurrence of primary postpartum hemorrhage is unpredictable, its prevention lies in the identification of the associated risk factors and proper management of the third stage of labor. Furthermore, maternal and fetal morbidity and mortality can be reduced by availability of trained personnel, surgical theatres and blood transfusion services.

ETHICAL ISSUES

Ethical clearance for the study was obtained from Institutional Review Board of the Faculty of Health sciences, University of Buea. While administrative approval was obtained from the Regional Delegation of Public Health, Littoral Region and the Chief Medical Officer of the hospital. Participants signed a consent form before delivery. For those who were not literate, consent was given after the participant thumb - printed a consent form after the study and what it entailed was explained to her in the language she best understood by a research assistant and interpreter. For those pregnant women who were less than 21years (legal age at which a patient can validly provide consent in Cameroon) assent was obtained from their parents or guardians.

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