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Risk factors for uterine atony in two semi-urban hospitals

Abstract

Objective: To look for uterine atony (UA) risk factors (RFs).

Methods: This case-control study was carried out between 1st February and 31st May 2019. All women with or without UA were recruited. The main variables recorded included gestational age at delivery, past-history of macrosomic baby (≥4000g), third trimester malaria, intrapartum fever, time spent from four cm cervical dilatation to delivery (TFD), birthweight, UA or not. Data were analysed using SPSS 21.0. Fisher's exact test, *t*-test and logistic regression were used for comparison. The level of significance was P<0.05.

Results: UA was present among 49 women (5.5%). Significant RFs for UA included multiple pregnancy (aOR 7.14, 95%CI 2.01-21.43), delivery before 34 weeks (aOR 5.72, 95%CI 1.24-22.04), TFD >10 hours (aOR 5.57, 95%CI 1.34-26.03), macrosomic baby (aOR 3.64, 95%CI 1.37-9.46), recent malaria or preeclampsia (aOR 3.11, 95%CI 1.11-9.79).

Conclusion: Measures to manage UA should be made ready when these RFs are present.

Keywords: uterine atony, risk factors, delivery before 34 weeks, malaria or preeclampsia within one month prior to delivery

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Abbreviations: UA,uterine atony; PPH, postpartum hemorrhage;CS, cesarean section

Introduction

Many complications can occur in the postpartum period, the period that extends from delivery to the 42nd day after delivery. These complications include hemorrhage, infection, thromboembolic diseases, psychosis, hypertensive diseases and other anomalies as well. The worst complication is postpartum hemorrhage (PPH). PPH, defined as a vaginal bleeding of ≥500 ml after vaginal or cesarean delivery,[1] is observed in 5.4% to 8.5% of deliveries.[2,3]It is the major cause of maternal mortality worldwide given that hemorrhagic shock can rapidly lead to neurological, renal, cardiac or respiratory organ dysfunction.[4,5]PPH is also responsible for the majority of cases of near-misses.[4] The commonest cause of PPH is uterine atony (UA), defined as the inability of the uterus to retract after delivery despite usual uterotonics administration. It is observed in 4% to 7% of deliveries.[6,7]UA represents up to 82% of cases of PPH.[8] Since UA is not always predictable, active management of third stage of labor (AMTSL) is mandatory if we want to prevent PPH.[9] AMTSL using intramuscular injection of 10 IU of oxytocin is practiced as routine in our maternities.

The risk factors (RFs) for UA are known only in 77% of cases.[6] Known risk factors include prolonged labor, multiple gestations, placenta previa, exposure to general anesthesia, ≥2 prior cesarean deliveries, prolonged labor or second stage of labor, birth weight >4000g, preeclampsia, chorioamnionitis, induction or augmentation of labor, maternal anemia, hydramnios and UA in a previous delivery.[2,6-8,10-12] Some other RFs might exist. Knowing the RFs might help in prevention or early diagnosis of some cases of UA. To the best of our knowledge, no study has evaluated the risk factors for UA in a sub-Saharan country. The aim of this study therefore was to evaluate such risk as a contribution to the reduction of maternal mortality.

Methods

This case control study was carried out between 1st February and 31st May, 2019 in two hospitals. All women with UA at delivery (inability to retract despite AMTSL, with habitually vaginal hemorrhage) who delivered after 28 complete weeks were recruited as cases. For each case, the three women without UA who delivered after 28 complete weeks immediately after the case were recruited as controls. A written informed consent was obtained from each woman or from their relatives. This study was approved by the institutional ethics committee. The main variables recorded on a pre-established questionnaire included maternal age at delivery, parity, past-history of chronic hypertension, gestational age at delivery (confirmed by an ultrasound scan performed before 20 weeks of gestation), HIV status, past history of macrosomic baby, PPH, of UA or cesarean section (CS), malaria in the third trimester, use of tocolytics in the 3rd trimester, whether the labor was induced or not, augmented or not, fever during labor, time spent between 4 cm cervical dilatation and delivery, mode of delivery, birthweight, Apgar score, whether there was uterine inertia or not.

The necessary minimum sample size was calculated as needing at least 45 cases of women with uterine atony, using the following formula: $N=2\times(Z\alpha+Z\beta/P0-P1)2 \times P\times(1-P)$, where $Z\alpha=1.28$ corresponding to a type I error of 10%, $Z\beta=0.84$ corresponding to a type II error of 20% or a power of 80%, P0 the prevalence of UA amongst women with previous PPH (18%)[2], P1 the prevalence of UA amongst women without previous PPH (3.9%)[2] and P is (P0+P1)/2. To increase the power of our study, we decided to recruit three controls for each case. Data were analyzed using SPSS 25.0. Data of women with UA were compared to those without UA. Fisher's exact test was used to compare categorical variables and t-test to compare continuous variables. We used odds ratios with their 95% confidence intervals (CIs) to present the comparison between the two groups.

Logistic regression was used to control for confounders. P<0.05 was considered statistically significant.

Results

During the study period, we had a total of 49 women with UA out of 891 deliveries, given a prevalence of 5.5%. On the other hand, 147 women without UA were recruited. Some sociodemographic and obstetrical variables of the study population are given in Table 1. Concerning parity, there was no statistically significant difference in both groups as concerns multiparity (parity 4 to 5) (26.5% vs 18.4%, OR 1.60, 95%CI 0.75-3.43, P=0.153) or grand multiparity (parity ≥6) (5 or 10.2% vs 10 or 6.8%, OR 1.56, 95%CI 0.50-4.80, P=0.309).The proportion of women living with HIV was similar in both groups (2 or 4.1% vs 4 or 2.7%, P=0.467) as well as the proportion of women with chronic hypertension (1 or 2.0% vs 1 or 0.7%, P=0.438).UA occurred a little bit more amongst women with past history of UA than amongst those without this entity (5 or 10.2% vs 10 or 6.8%, OR 1.91, 95%CI 0.66-5.57), but the difference was statistically insignificant (P=0.309). There was no association between past history of CS and UA (3 or 6.1% vs 7 or 4.7%, OR 1.30, 95%CI 0.32-5.25, P=0.476).

Table 1 Some sociodemographic characteristics of the population under study

Variables		Women (n=49) with uterine atony N (%)	Women (n=147) without uterine atony N (%)	OR	95% CI	P-value
Mother's age (year)		27.9±6.4 (16-40)	27.4±5.7 (16-40)	-	-	0.607
Parity		2.9±1.7 (1-6)	2.5±1.6 (1-9)	-	-	0.137
Maternal age (year)	≥35	11 (22.4)	16 (10.9)	2.37	1.01-5.53	0.04
	<35	38 (77.6)	131 (89.1)			
Past history of macrosomia	Yes	22 (44.9)	32 (21.8)	2.93	1.47-5.81	0.002
	No	27 (55.1)	115 (78.2)			
Multiple pregnancy	Yes	7 (14.3)	4 (2.7)	5.95	1.66-21.33	0.006
	No	42 (85.7)	143 (97.3)			
Tocolysis within four weeks before delivery	Yes	3 (6.1)	4 (2.7)	2.33	0.50-10.80	0.24
	No	46 (93.9)	143 (97.3)			
Delivery at <34 weeks	Yes	5 (10.2)	2 (1.4)	8.23	1.54-43.95	0.011
	No	44 (89.8)	145 (98.6)			
Macrosomic baby* (≥4000g)	Yes	9 (21.4)	11 (7.7)	3.21	1.25-8.54	0.016
	No	33 (78.6)	132 (92.3)			

OR, odds ratio; CI,confidence interval, BD,before delivery;*cases of multiple pregnancies excluded.

Although there was no difference regarding mean maternal age, women aged 35 or above were more at risk for UA (Table 1). Table 2 gives age groups distribution amongst the study population.Pregnant women in whom tocolysis were done within one month before delivery were also at risk of UA, although the difference was statistically insignificant (3 or 6.1% vs 4 or 2.7%, OR 2.33, 95%CI 0.50-10.80, P=0.240). Women whose labor was induced were also at risk of UA, although the difference was statistically insignificant (4 or 8.2% vs 10 or 6.8%, OR 1.22, 95%CI 0.36-4.07, P=0.480).Also, women who received tocolytics during the latent phase of labor were also at risk of UA, although the difference was statistically insignificant (2 or 4.1% vs 1 or 0.7%, OR 6.21, 95%CI 0.55-70.07, P=0.154), as well as those whose labor was augmented (16 or32.7% vs 34 or 23.1%, OR 1.61, 95%CI 0.79-3.28, P=0.129).

Premature deliveries (<37 weeks gestations) were commoner amongst cases than among controls (7 or 14.3% vs 9 or 6.1%, OR 2.55, 95%CI 0.89-7.28), although the difference was statistically insignificant (P=0.07). The rates of post-term pregnancies (>42 weeks gestation) were similar in both groups (2 or 4.1% vs 9 or 4.1%, OR 1, 95%CI 0.20-4.79, P=0.680).

With regards to the current mode of delivery, 33 CSs were carried out in the study population. UA occurred in 11 women (22.5%) amongst cases and 22 (15%) amongst controls (OR 1.63, 95%CI 0.73-3.66, P=0.161). The duration of active phase of labor (time spent from four cm cervical dilatation to full cervical dilatation) and second stage of labor (time spent from full cervical dilatation to delivery of the newborn) was obtained amongst 23 cases and 77 controls only, given that some women were received at advanced cervical dilatation. Women who spent more than 10 hours from 4 cm cervical dilatation to delivery were more found in the UA group than amongst controls (4/23 or 17.4% vs 3/77 or 3.9%, OR 5.19, 95%CI 1.07-25.20, P=0.047).Amongst women with singleton pregnancies, those

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whose baby weighed 4000 g or more were more at risk for UA (Table 3).Women who had malaria or preeclampsia within one month before delivery were also at risk of UA (9 or 17.6% vs 7 or 4.6%, OR 4.50, 95%CI 1.57-12.84, P=0.005). Three women who had fever during labor developed UA.After logistic regression, risk factors for UA were multiple pregnancy, delivery before 34 weeks gestation, duration of active phase and second stage of labor >10 hours, macrosomic baby (≥4000g), past history of macrosomic baby, malaria or pre-eclampsia within four weeks before delivery and maternal age ≥35 years(Table 4).

Table 2 Distribution of maternal ages amongst the study population

Maternal ages (y)	Women (n=49) with uterine atony N (%)	Women (n=147) without uterine atony N (%)	OR	95% CI	P-value
16-19	3 (6.1)	12 (8.2)	0.73	0.20-2.72	0.456
20-24	15 (30.6)	36 (24.5)	1.36	0.67-2.78	0.252
25-29	15 (30.6)	48 (32.7)	0.91	0.45-1.83	0.469
30-34	5 (10.2)	35 (23.8)	0.36	0.13-0.99	0.028
35-39	10 (20.4)	13 (8.8)	2.64	1.07-6.49	0.031
40-44	1 (2.0)	3 (2.0)	1	0.10-9.84	0.739

OR,odds ratio; CI,confidence interval

Table 3 Distribution of birth weights of singletons in the study population

Birth weights (g)	Women (n=49) with uterine atony N (%)	Women (n=147) without uterine atony N (%)	OR	95% CI	P-value
<2000	1 (2.4)	0 (0)	-	-	0.25
2000 – 2499	0 (0)	2 (1.4)	-	-	0.561
2500 - 2999	0 (0)	25 (17.5)	-	-	<0.001
3000 - 3499	21 (50)	68 (47.5)	1.1	0.55-2.19	0.402
3500 - 3999	11 (26.2)	37 (25.9)	1.01	0.46-2.22	0.43
≥4000	9 (21.4)	11 (7.7)	3.27	1.25-8.54	0.016
Total	42 (100)	143 (100)			

OR,odds ratio; CI,confidence interval

Table 4 Independent risk factors for uterine atony

Risk factors	OR	95%CI	P-value	aOR	95%CI	P-value
Multiple pregnancy	5.95	1.66-21.33	0.006	7.14	2.01-21.43	0.004
Delivery <34 weeks gestation	8.24	1.54-43.95	0.011	5.72	1.24-22.04	0.019
>10 h spent from 4 cm to delivery	5.19	1.07-25.20	0.047	5.57	1.34-26.03	0.032
Macrosomic baby (≥4000g)	3.27	1.25-8.54	0.016	3.64	1.37-9.46	0.019
Past-history of macrosomic baby	2.93	1.47-5.81	0.002	3.23	1.47-6.70	0.001
Malaria/preeclampsia within FWBD	4.5	1.57-12.83	0.005	3.11	1.11-9.79	0.021
Maternal age ≥35 years	2.37	1.01-5.53	0.04	2.86	1.33-6.01	0.049

OR,odds ratio; CI,confidence interval;aOR, adjusted odds ratio; FWBD, four weeks before delivery

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The protective factors were singleton pregnancy (OR 0.16, 95%CI 0.04-0.60, P=0.006), absence of malaria or preeclampsia within four weeks before delivery (OR 0.22, 95%CI 0.07-0.63, P=0.005) and total duration of active phase and second stage of labor between 4 and 10 hours (7/23 or 30.4% vs 45/77 or 58.4%, OR 0.31, 95%CI 0.11-0.84, P=0.016).

Discussion

Our prevalence of UA was 5.5%. The significant risk factors for UA in our study was multiple pregnancy, delivery before 34 weeks gestation, time spent from 4 cm cervical dilatation to delivery >10 hours, macrosomic baby (≥4000g), past history of macrosomic baby, malaria or preeclampsia within four weeks before delivery and maternal age ≥35 years. Our prevalence of UA was within the range of 4% to 7% found in the literature.[6,7]We observed no association between UA and chronic hypertension, multiparity, HIV status or labor augmentation. We found a slightly increased risk of UA amongst women with past history of UA, tocolysis within one month before delivery or in the latent phase, induction of labor or labor augmentation, but the difference was statistically insignificant. These findings are in contrast with those of other researchers.[2,7,10]The lack of statistically significant difference in our series might be due to our small sample size.

In our study, multiple gestation was significantly associated with UA, even after logistic regression. This has already been noticed elsewhere.[6] This can be explained by the uterus overdistention that is associated with poor response to uterus massage and uterotonics. Delivery before 34 weeks was a risk factor for UA in our study. The explanation is unknown. The uterus might be less sensitive to uterotonics because of insufficient uterotonic receptors. Studies should be carried out to explain this observation.Women who spent more than 10 hours from 4 cm cervical dilatation to delivery were at risk of UA. This might be attributed to uterine muscle exhaustion. Some authors found that prolonged labor was a risk factor for UA,[8,10]while for others, only prolonged second stage of labor was a risk factor for UA.[13]

Also, women who delivered a baby that weighed 4000g or more were also at risk of UA even after control for confounding factors, as already observed by other researchers.[11–13]It can be explained by the overdistension of uterus that is associated with poor response to uterus massage and uterotonics.Women with past history of macrosomia were at risk for UA, even after adjustment for confounding factors. This has not yet been observed elsewhere. The mechanism is unknown. Studies should be carried out to explain this.Maternal diseases such as malaria or preeclampsia within four weeks before delivery was a risk factor for UA, even after logistic regression. Preeclampsia is a known risk factor for UA.[7]The relationship between malaria and UA could be the presence of anemia. Malaria can induce maternal anemia and anemia is a known cause of UA.[7,14]Maternal age ≥35 was also a risk factor for UA, even after logistic regression. This is contrast with the findings of other researchers.[15]

Finally, fever during labor, whatever the cause was another risk factor in our series. It has been shown that two hours after onset of maternal fever, there is a decline in myometrial contractility.[16]Women with fever should be actively managed for prevention of UA.The major limitations of our study were our small sample size due to the fact that the study was carried out in two semi-urban hospitals where there were few deliveries. Moreover, we could not study the impact of anemia on UA given that some women did not have a recent hemogram.

Conclusion

The newly UA RFs observed in this study were delivery before 34 weeks gestation, TFD >10 hours, past-history of macrosomic baby, malaria or pre-eclampsia within four weeks before delivery. Therefore, women with such conditions should be well observed in the postpartum period, so as to identify and manage an eventual UA rapidly.

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Conflicts of interest

Author declare that there is no conflict of interest.

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