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Accuracy in diagnosis of postpartum haemorrhage using visual estimation of blood loss versus change in haematocrit in a tertiary teaching hospital in Tanzania

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Abstract: Postpartum haemorrhage is the leading cause of maternal death in the developing country and yet is poorly diagnosed due to inaccurate measurement of blood loss following delivery. A study was carried out at Muhimbili National Hospital (MNH) Tanzania between October 2005 and January 2006 to determine the accuracy of visual estimation of blood loss (VEBL) in comparison to laboratory measurement of blood loss in diagnosis of primary postpartum haemorrhage (PPH). A total of 426 pregnant women who were in active phase of labour were recruited and their venous blood was drawn for estimation of haematocrit before delivery and 12 hours thereafter. Active management of third stage of labour was conducted by giving 10IU of oxytocin (intramuscularly or intravenously) and this was followed by visual estimation of blood loss. The proportion of patients who developed PPH was then determined by both methods. The mean duration of third stage of labour was 8.3 minutes and mean blood loss was 164.9ml. The prevalence of PPH was 8.9% and 16.2% by VEBL and changes in haematocrit, respectively. Change in haematocrit in diagnosis of PPH was found to be more accurate, specific with high positive predictive values compared to VEBL. The need for additional uterotonics was 5.8% and the commonest labour complications associated with PPH were second degree tear, retained placenta and EUA for continued bleeding. In conclusion, VEBL using calibrated vessel will increase accuracy where conventional method using non calibrated method is used for diagnosis of PPH. Service providers working in labour wards need to be trained on how to estimate blood loss using simulated methods so as to increase their long term memory and accuracy in diagnosis of post-partum haemorrhage, hence provision of immediate intervention.

Keywords: visual estimation, blood loss, postpartum, haemorrhage, haematocrit, Tanzania

Introduction

Diagnosis of postpartum haemorrhage (PPH) in poor resource countries where there is high prevalence of anaemia in pregnancy is a challenging problem especially when there are no symptoms of cardiac failure due to physiological compensatory mechanism which occurs immediately after delivery. PPH accounts for a quarter of all maternal deaths worldwide (Chong & Su, 2006) but this tends to be underestimated in the poor resource countries. The high prevalence of anaemia among pregnant women in low income countries makes even a modest PPH more serious and life threatening. Mortality from PPH has remained high in low income countries despite international efforts to decrease maternal mortality since the launch of the Safe Motherhood Initiative in 1987 (Hofmeyr *et al.*, 2009. At the Muhimbili National Hospital in Tanzania PPH is among the leading cause of maternal mortality and has been reported to be the second leading cause of emergency peripartum hysterectomy (Pembe *et al.*, 2012). Active

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management of the third stage of labour (AMTSL) is the primary intervention known to reduce the incidence of PPH and the World Health Organization (WHO) and International Council for Midwifery (ICM) recommends this to be implemented using oxytocin (Anderson & Etches, 2007). However discrepancy in diagnosis of PPH due to inaccurate in estimating actual blood loss (associated with observed error) where different methods has been employed limits accuracy in diagnosis of PPH hence ending up with postpartum complication (Rath, 2011). More importantly the greatest risk of maternal death is among women who deliver at home, either alone or assisted with traditional birth attendant (Prata *et al.*, 2005).

In view of the magnitude of maternal mortality in Tanzania where majority of the patients are anaemic, there is a need to conduct regular on job training on methods of diagnosis of primary PPH and therefore increase accuracy in its diagnosis and provide early intervention. The objective of this study therefore was to determine the accuracy of diagnosis of PPH using Visual Estimation of Blood Loss (VEBL) in comparison with actual measurement of blood loss using laboratory investigation by determining drop in haematocrit twelve hours after vaginal delivery.

Materials and Methods

Study Setting

A prospective analytical study was conducted at the labour ward of the Muhimbili National Hospital (MNH) in Dar es Salaam, Tanzania. Muhimbili National Hospital is the largest referral hospital and a teaching hospital for the Muhimbili University of Health and Allied Sciences. About 20-30 deliveries take place in 24 hours with an average of 9,000-11,000 deliveries per year. The gold standard for estimation of blood loss after delivery in the hospital is through visual estimation (VEBL). There is no actual measurement of blood loss using the calibrated jar due to the difficulties encountered either blood mixed with liquor, urine and lack of enough staff working in this busy labour ward.

Study population and data collection

The study consisted of all pregnant women admitted in the active phase of labour between October 2005 and January 2006. During the study period there were 2882 delivery. However, 2487 women were excluded from the study due to not meeting the inclusion criteria. The exclusion criteria were women were women admitted in second stage of labour, at night, had preeclampsia, eclampsia and multiple pregnancies. A total of 426 women who were admitted in the hospital for delivery between 08.00 and 15.00 hours were recruited in the study. Their venous blood was drawn for estimation of haematocrit before delivery and 12 hours thereafter. A change of haematocrit of more than 10% after delivery was considered to be significant hence diagnosis of primary PPH.

Active management of the third stage of labour was done by intramuscular (IM) administration of 10U of oxytocin one minute after delivery of the baby according to the hospital guidelines. The placenta delivered by controlled cord traction and that needed for additional uterotonic agents were assessed by manual palpation of the uterus NOT CLEAR. Estimation of blood loss was done visually as explained above. Any patient with VEBL more

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than 500ml was diagnosed to have primary PPH and if had poorly contracted uterus with continued bleeding was given additional uterotonics drugs after ruling out other causes of bleeding.

Data analysis

Of the recruited subjects, 12 women delivered by emergency caesarean section. In 11 women, haematocrit could not be traced 12 hours after delivery and eight women had some of their information missing hence these were excluded from the analysis. All data were entered into a computer using Epi-Info-6 software. Socio-demographic information including gestational age, parity, admitting haematocrit, visually estimated blood loss at delivery and the postpartum haematocrit 12 hours post-delivery were recorded. Haematocrit change was calculated by subtracting the 12 hours post-delivery haematocrit from the admitting haematocrit. The drop in haematocrit was divided to the admitting haematocrit then computed into percentage. The change of haematocrit of more than 10% was considered to be PPH. Data analysis was done using SPSS (Statistical Package13 for Social Sciences) programme. A p-value of less than 0.05 was considered statistically significant.

Ethical consideration

Ethical approval was provided by the Research and Publication Committee of the Muhimbili University of Health and Allied Sciences, Tanzania. All women gave informed consent after being informed in detail the aims of the study.

Results

Data from 395 women were analyzed and the average visual estimation of blood loss (VEBL) was 164.9±120.2ml with primary PPH rate of 8.9%. The average 12 hours postpartum haematocrit change was 5.3 (range = -0.48 to 19.7) with primary PPH rate of 16.2% (Table1). The mean duration of third stage of labour was 8.3 minutes and the need for additional uterotonics was 5.8%. The commonest labour complications encountered were second degree tear, retained placenta and EUA for continued bleeding; these are some of the causes of primary PPH.

Table 1: Characteristics of study participants and diagnosis of PPH by visual estimation of blood loss (VEBL) versus change in haematocrit

Variable	Response	Number	%
Gestational age (weeks)	≤36	49	12.4
	>36	346	87.6
Parity	1-3	264	66.8
	>3	131	33.2
VEBL	≥500 PPH	35	8.9
	<499 no PPH	360	91.1
Need for additional oxytocin	Yes	54	13.7
	No	341	86.3
Labour complication	Examination under anaesthesia	12	3.0

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	Retained Placenta	11	2.8
	Cervical tear	3	0.8
	Second degree tear	14	3.6
Duration of 3rd stage of labour	Normal (<15 min)	343	86.8
	Prolonged (≥15min)	52	13.2
Mother on augmentation	Yes	100	25.3
	No	295	74.7
PROM	Yes	57	14.4
	No	338	85.6
Mean blood loss (ml)	164.9		
Mean change in haematocrit	5.3		

The proportion of women who had PPH as a result of change in haematocrit of more than 10% was higher compared to the routine diagnosis of primary PPH using VEBL (Tables 1 and 2). However the need for blood transfusion was very low (1.9 %). The minimum blood loss was reported to be 50ml whereas the maximum was 1120ml. The mean haematocrit before and after delivery was 33.2 and 30.4, respectively. Less than half of the study population had less than 28 haematocrit before delivery with almost normal distribution curve. However, 12 hours after delivery half of the study population had less than 28 haematocrit with the distribution curve skewing to the right indicating significant change after delivery (Figures 1 and 2). The change in haematocrit was more accurate, sensitive with high positive predictive value in diagnosis of PPH compared to VEBL (Table 2).

Table 2: Haematocrit change and visual estimated blood loss (VEBL) in diagnosis of PPH

	PPH	No PPH	Sensitivity	Specificity	PPV	NPV	Accuracy
VEBL	35	360	34.3	47.7	8.86	83.04	45.9
Change in haematocrit	67	328	65.7	52.3	16.9	91.1	54.1

Key: PPV= positive predictive value; NPV= negative predictive value

When regression analysis for VEBL and change in haematocrit was used, there was a statistically significant correlation between the change in haematocrit and the VEBL (Pearson's correlation r=0.286, $P< 0.01$).The T-statistic value for VEBL was the smallest at -5.324 negative and very significant. This indicated that all patients who had PPH by VEBL (8.9%) had a drop in haematocrit. There was a steady decline in the haematocrit change with an increase in the average VEBL.

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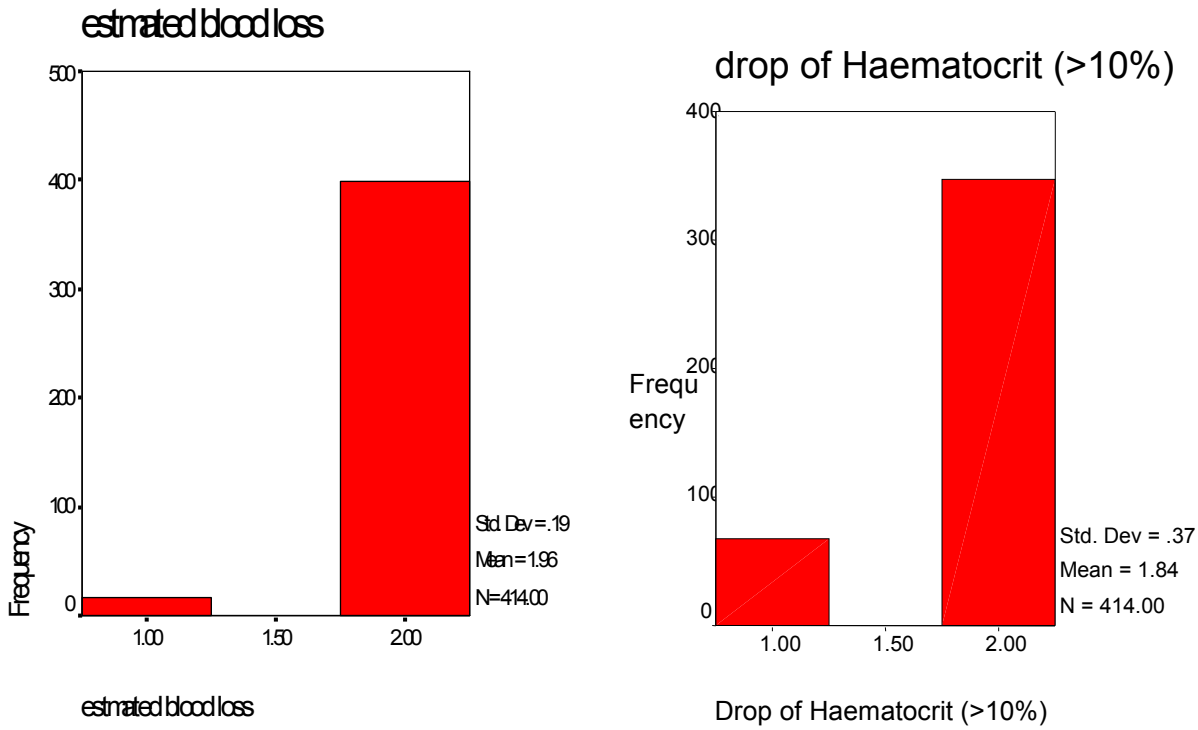

Figure 1: Diagnosis of primary PPH

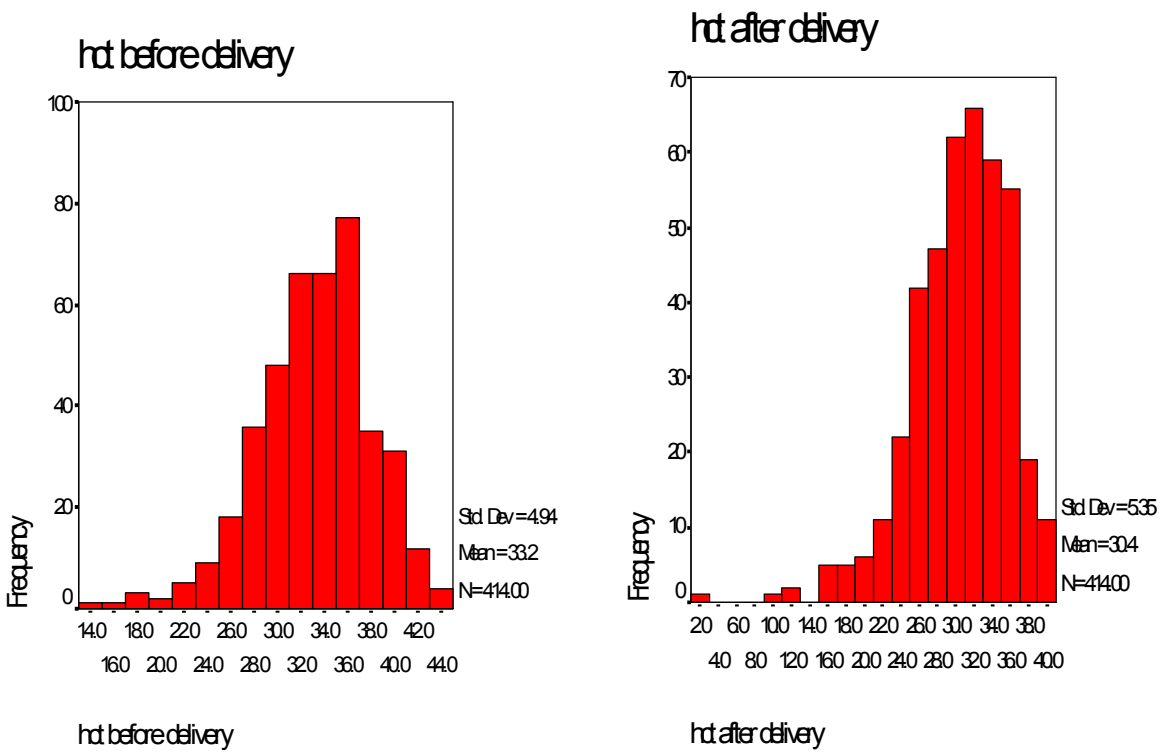

Figure 2: Change of haematocrit before and 12 hours after delivery

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Discussion

The study demonstrate a significant gap in diagnosis of primary PPH using visual estimation of blood loss during third stage of labour compared to the laboratory diagnosis. The average blood loss identified in the study (164.9) demonstrates an observer error especially when the non calibrated vessels are used to estimate blood loss. In our hospital the common vessel used in collecting blood loss after delivery is the kidney dish which is non-calibrated. Studies elsewhere using calibrated method demonstrated that there is improved accuracy in VEBL following prolonged use of calibrated vessels (Toledo *et al*., 2007*)*. Muhimbili being a tertiary and teaching for both medical and nursing students need to upgrade their methods of estimating blood loss after delivery by providing the calibrated vessel so as to increase the long term memory in accurately estimating blood loss following delivery. Accurate diagnosis and prompt intervention of primary PPH is the key solution for prevention of maternal death related to PPH in most centres (Anderson & Etches, 2007)).

In poor resource countries like Tanzania, primary PPH is the leading cause of maternal mortality despite of several interventions put in place. A study done in Thailand (Prasertcharoensuk *et al.,* 2000) identified that the incidence of PPH by VEBL was 5.6% compared to actual measurement of blood loss where the incidence was 27.6% which is not far from our finding when change in haematocrit was used The use of a change in haematocrit of more than 10% as a method of diagnosis of PPH compared to VEBL at delivery is more sensitive in diagnosis of PPH as demonstrated by some studies (Hofmeyr *et al.,* 2005; Okonofua, 2005; Parsons *et al.,* 2006). However this being retrospective method is not helpful for the immediate management of the patients hence leading to undetected morbidities which always lead to patient's readmission (Cameron & Robson, 2006).

VEBL using non calibrated vessels have been reported to have significant observational errors, which often lead to underestimation of blood loss (Prata *et al.,* 2005; Schorn, 2010). This method suffer from a theoretical teaching that vaginal blood loss following normal delivery is 200-500ml without conducting actual simulation where trainee has to measure actual blood loss followed by visual estimation. This teaching is also misleading when anaemic patients and patients with preeclampsia and eclampsia who are having contracted intravascular blood volume bleed, minimal bleeding to them means a lot compared to health women in labour (Higgins, 2003). Therefore this definition needs to be reviewed due to the fact that quantification of blood loss has several limitations ranging from the patients factor to the service providers factor. Most service providers tend to underestimates blood loss between 30-50% when there is excessive blood loss (Duthie *et al*., 1991; Razvi *et al.,* 1996; Patel *et al.,* 2006; Sharon *et al.,* 2008).

In comparing PPH due to VEBL and change in haematocrit, our findings observed the error to be higher than in other studies (Razvi *et al.,* 1996; Patel *et al.,* 2006; Sharon *et al.,* 2008)) but lower compared findings from studies by Toledo *et al.* (2007) and Yoong *et al*. (2010). This calls for a need to conduct a simulation study among services providers working in labour ward on accurate estimation of blood loss using both calibrated and non calibrated vessel (Dildy *et al*., 2004; Bose *et al*., 2006; Patel *et al*., 2006*).* The steady decline in the haematocrit change with an increase in the average VEBL was similar to findings by Gharoro & Enabudoso (2009) but different from what was reported by Al Kadri *et al. (*2011).

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Despite of the high predictive values of detecting primary PPH by change in haematocrit, the study did not look at some of the factors which may affect change in haematocrit hence leading to high proportion of patient with PPH. The duration of labour which in most cases if it is prolonged is associated with dehydration is an important factor which was beyond the scope of this study. A significant number of women were on augmentation. The amount of fluid received during augmentation or during induction which also can affect the change of haematocrit leading to wrong diagnosis of PPH was not investigated. Patients who had complication during delivery and received some intervention like intravenous fluids and blood transfusion was not investigated to see how much was related with the change of haematocrit.

In conclusion, VEBL using calibrated vessel will increase accuracy where conventional method using non calibrated method is used for diagnosis of PPH. Service providers working in labour wards need to be trained on how to estimate blood loss using simulated methods so as to increase their long term memory and accuracy in diagnosis of post-partum haemorrhage, hence provision of immediate intervention.

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Declaration of interest

None.

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