

ORIGINAL STUDIES

Standardized Visual Estimation of Blood Loss during Vaginal Delivery with its Correlation Hematocrit Changes—A Descriptive Study

¹Bellad MB, ²Laxmi BV, ³Goudar SS, ⁴Ashwath Kumar

¹Professor, Department of Obstetrics and Gynecology, JN Medical College, Belgaum - 590010, Karnataka, India

²Resident in Obstetrics and Gynecology, JN Medical College, Belgaum - 590010, Karnataka, India

³Professor, Department of Physiology, JN Medical College, Belgaum - 590010, Karnataka, India

⁴Resident in Physiology, JN Medical College, Belgaum - 590010, Karnataka, India

Correspondence: Bellad MB, Professor, Department of Obstetrics and Gynecology, JN Medical College Belgaum - 590010, Karnataka, India, Mobile: +91-9448124893, e-mail: mbbellad@hotmail.com

Abstract

Introduction: Postpartum hemorrhage is a leading cause of maternal morbidity and mortality. Traditionally, visual method with variations in accuracy is followed, because it is quick, simple and noninvasive. To rely on this method accuracy is of vital importance. This study was aimed to improve accuracy of visual estimation of blood loss during vaginal delivery by standardizing (using similar sized mops and a fixed container) and correlating with hematocrit changes.

Methods design: A descriptive study.

Sample size: 250 women.

Single fixed collecting container and similar sized mops were used in the third stage of labor. Blood was drained into the container and was visually calibrated by a single trained observer. The soaking characteristics of the mops were used to estimate total blood loss. Blood spillage on delivery table, garments and floor were approximately assessed. Total blood loss was calculated from the above three sources.

Hemoglobin and hematocrit measurements were done at the time of admission and, at 24 and 72 hours postpartum and its correlation was done with blood loss.

Analysis: By paired and unpaired 't' test.

Results: 250 out of 269 women completed the study. Incidence of PPH (> 500 ml) was 11.2%. The estimated blood loss correlated well with the hemoglobin and hematocrit changes postpartum.

Conclusion: Standardized visual method (fixed container and mops) with trained observer improves the accuracy of estimation. This may assist clinicians to accurately estimate blood loss thus preventing hemorrhage related complications.

Keywords: Postpartum hemorrhage, visual estimation, hematocrit.

INTRODUCTION

India has a maternal mortality rate of 407/1,00,000 live births estimated for the year 2000.¹ Hemorrhage is the single most important cause of maternal death worldwide. Twenty-five percent of all maternal deaths are due to hemorrhage; the proportions range from <10% nearly 60% in various countries.² Under estimation of peripartum blood loss and delayed blood component therapy seem to be common factors in many cases of avoidable hemorrhage related maternal deaths. Inaccurate blood loss assessment can result in significant adverse sequelae: Under estimation in delayed treatment and over estimation in unnecessary transfusion. Delayed diagnosis and treatment may lead to hypovolemic shock and death.³

Traditionally, blood loss in third stage of labor is visually estimated with variations in accuracy mainly due to subjective observation. The current standard practice of the blood loss assessment is visual estimation by health care provider. Who looks grossly at the blood loss during delivery and makes a quantitative estimate but is liable for subjective variation.⁴

Most of the investigated methods have not been widely adopted as they are practical or affordable in clinical setting because they are complicated, needs more effort and are expensive.

An analysis of blood loss during vaginal delivery is important for several regions. The accurate assessment of blood loss is a guide both to the treatment and to identify the causes of excessive blood loss. This helps in early diagnosis and treatment thus prevents morbidity and mortality associated with

excessive blood loss. Visual method of blood loss estimation is one of the simplest and noninvasive techniques. To rely on this method accuracy is of vital importance. The present study was aimed at improving the accuracy by standardizing visual estimation using fixed collecting container and similar sized mops (prior assessment of blood volume with different percentage of soakage of the mops). This estimated blood loss was correlated with hematocrit changes to assess the accuracy of this method.

Standardized visual estimation can become simple practical method that can be routinely practiced in low resource settings to detect excessive blood loss at the earliest.

OBJECTIVES

- Accurate estimation of blood loss during vaginal delivery by standardized visual method.
- Correlate estimated blood loss to postpartum hematocrit changes.

METHODS

Study design: One year hospital based controlled clinical study.

Place of study: Department of Obstetrics and Gynecology, JN Medical college, Belgaum, Karnataka, India.

Period: March 2004, February 2005.

Sample size: Random sample size of 250 women presented to laborroom at District Hospital, Belgaum (Sample size was calculated with confidence interval 95% and power at 80% with 20% error).

Inclusion Criteria

Women presenting for:

- Vaginal delivery.
- Singleton pregnancy.
- Willing to consent.



Exclusion Criteria

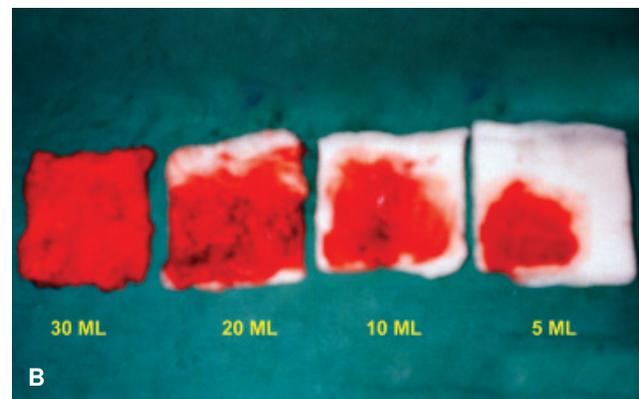
- Women not willing to consent.
- Planned/emergency cesarean section.
- Antepartum hemorrhage.
- PIH/pre-eclampsia.
- With episiotomy.
- Instrumental deliveries.
- Hemoglobin < 8 grams.
- Maternal death.

Training

In this study blood loss estimation was done by single health care provider who was trained to estimate blood loss using single collecting container and fixed sized mops of 10 × 10 cm. Simulated scenarios with known major blood volume were created and calibrated visually (the same container was used throughout the study). The soaking characteristics of the mops used in this study with known different volumes of blood were noted.

Visual Estimation of Blood Loss

- Blood loss estimation was done by a single health care provider who was trained in estimating the blood loss to avoid inter observer variation. Blood loss estimation was done from the onset of third stage of labor to the end of stoppage of active bleed or up to 1 hour post delivery, wherever was earlier.
- The blood was allowed to drain into a fixed collecting container and was calibrated at the end of 1 hour.
- Fixed sized mops were used in the present study. Depending on the soakage percentage the blood volume was calculated as depicted in the Figures 1A and B.
- Blood spillage in the delivery table, garments and floor were approximately assessed.



Figs 1A and B: Soakage percentage the blood volume

- At the end of 1 hour, the total amount of blood lost was estimated by adding up the blood in the container, amount of blood in the mops and blood spillage on delivery table, garments and floor.

Laboratory Measurements

- Baseline hematocrit and hemoglobin measurements were done at the time of admission to the labor wards.
- Serial hematocrit using Wintrobe's method and hemoglobin measurements using Drabkin's cyanmethemoglobin method were done 24 hours and 72 hours postpartum.

The person performing the laboratory investigations was kept blinded about the blood loss.

Clinical Parameters

- Baseline pulse rate and blood pressure were recorded at the time of admission to the labor ward.
- After delivery—pulse rate and blood pressure measurements were taken every 30 minutes for 1 hour, and then after 24 hours and at 72 hours.
- Symptoms like inability to pass urine, inability to ambulate, and dizziness were asked for during each visit after delivery.

Other Outcomes Noted

- Complication of third stage of labor.
- Additional use of oxytocics.
- Surgical interventions in the third stage of labor.
- Maternal mortality.

ANALYSIS

Comparison in hemoglobin and hematocrit changes and other parameters between different groups were done by using unpaired 't' test and paired 't' test.

Differences between two were considered significant when $p < 0.05$.

RESULTS

Two hundred sixty-nine women were enrolled into the study. Out of which 267 cases were available for follow-up on day 1. Only 250 women were completed up to 3rd day follow-up hence

only 250 women were included for statistical analysis. The mean age of the participants was 24.0 ± 3.5 years and the mean gestational age was 39.6 ± 1.4 weeks. The mean birth weight was 2.8 ± 0.4 kg. Predelivery mean hemoglobin and mean hematocrit values were 11.2 ± 1.4 gm/dl and $35.3 \pm 4.2\%$ respectively as shown in Table 1.

Table 1: Study group demography

Demographic characteristics	Mean + Std. Deviation (range)
Age (yrs)	24.03 ± 3.52 yrs (17-37)
Gravida	2.6 ± 0.8 (1-5)
Parity	1.51 ± 0.74 (0-4)
Number of living children	1.4 ± 0.71(0-4)
Abortion	1.12 ± 0.35 (0-2)
Mean gestational age (weeks)	39.56 ± 1.43 (36.14-42.86)
Hb day 0 (gm/dl)	11.19 ± 1.36 (7.6-17)
Hct day 0 (%)	35.32 ± 4.15 (23.8-52.1)
Weight of baby (kg)	2.77 ± 0.41 (1.76-3.75)

The blood loss estimated by standardized visual estimation was in the range of 20 to 1660 ml. The mean blood loss for the whole study was 244.14 ± 191.81 ml.

Out of the 250 women 239 were of spontaneous labor and 11 were induced. The mean blood loss in spontaneous labor groups was 241.9 ± 192.7 ml and in the induced group it was 291.8 ± 172.3 ml. However, the difference between the two was statistically not significant. The incidence of postpartum hemorrhage in this study was 11.2%. Out of 250 cases, 28 women had blood loss of > 500 ml, two had blood loss of more than 1000 ml and 222 women had blood loss of < 500 ml as shown in Table 2.

Table 2: Incidence of postpartum hemorrhage

Blood loss (ml)	Number	Percentage
< 500	222	88.88
500-1000	26	10.4
> 1000	2	0.8

The mean predelivery hemoglobin, hematocrit, pulse rate at admission, mean systolic and diastolic blood pressures gradually dropped on the 3rd postnatal day as shown in Table 3.

Table 3: Pre- and post-delivery changes

	Day 0 (n = 250)	Day 1 (n = 250)	Day 3 (n = 250)
Haemoglobin (gm/dl)	11.19 ± 1.36	10.51 ± 1.29	9.81 ± 1.28
Hematocrit (%)	35.32 ± 4.15	33.11 ± 3.66	31.02 ± 3.53
Pulse rate (rate/min)	81.6 ± 5.81	78.26 ± 7.31	75.80 ± 8.08
Systolic BP (mm Hg)	119.77 ± 8.46	114.82 ± 6.66	112.34 ± 6.66
Diastolic BP (mm Hg)	76.88 ± 6.59	72.83 ± 4.71	71.83 ± 4.33

Blood Loss

One hundred twenty-eight women had blood loss ≤ 199 ml, with the mean blood loss of 155.59 ± 42.18 ml (range 20-195 ml). Ninety-four women had blood loss between 200-499 ml with the mean blood loss of 300.69 ± 81.36 ml (range 200-490 ml) and 28 women had blood loss of > 500 ml with the mean blood loss of 641.96 ± 233.49 ml (range 500-1660 ml) as shown in Table 4.

Table 4: Mean blood loss in different groups (ml)

	Mean blood loss (ml)	Range (ml)
< 200 ml (n = 128)	115.59 ± 42.18	20-195
200-500 ml (n = 94)	300.69 ± 81.36	200-490
≥ 500 ml (n = 28)	641.96 ± 233.49	500-1660

Hemoglobin Changes

There were no statistical significant differences in the predelivery hemoglobin between the three groups (blood loss up to 199 ml, between 200-499 ml and > 500 ml). There was a mean drop of 1.205 gram/dl in blood loss up to 199 ml group, this was 1.393 gm/dl and 2.157 gram/dl in women with blood loss between 200-500 ml group and > 500 ml blood loss group

respectively. The drop in hemoglobin level in women with > 500 ml blood loss group on the third postnatal day was statistically significant compared to other groups. Similar observation was noted with hematocrit changes too, as shown in Table 5.

Pulse Rate Changes

Statistically significant difference in the pulse rate changes were noted on day 0 in women with blood loss of ≥ 500 ml compared to the other groups with the blood loss of ≤ 499 ml, statistically significant differences ($p < 0.05$) were noted at 30, 60 minutes and up to 24 hours in women with blood loss of > 500 ml compared to other two groups. However, there was no statistically significant difference between the groups in the blood pressure recordings.

The mean duration of first stage of labor was longer (8.75 hours) in women with blood loss of ≥ 500 ml compared to 7.2 hours and 6.9 hours in women with blood loss of up to 199 ml and between 200-499 ml groups respectively. This was statistically significant ($p < 0.05$). However, the mean duration of third stage of labor was 5.16 minutes, 5.62 minutes and 5.43 minutes in women with blood loss up to 199 ml, between 200-499 ml respectively, there was no statistically significant difference in the third stage of labor between the groups as depicted in Table 6.

Table 5: Hemoglobin (g/dl) and hematocrit (%) changes

Blood loss	Day 0		Day 1		Day 3	
	Hb (g/dl)	Ht (%)	Hb (g/dl)	Ht (%)	Hb (g/dl)	Ht (%)
< 200 ml (n = 128)	11.14 ± 1.31	35.35 ± 3.74	10.52 ± 1.15	33.08 ± 3.2	9.93 ± 1.15	31.46 ± 3.16
					p = 0.75	
201-500 ml (n = 94)	11.23 ± 1.44	35.35 ± 4.67	10.62 ± 1.39	33.59 ± 4.05	9.83 ± 1.33	31.09 ± 3.73
					p = 0.2	
> 500 ml (n = 28)	11.29 ± 1.33	35.05 ± 4.20	10.10 ± 1.53	31.58 ± 3.93	9.13 ± 1.51	28.77 ± 3.68
					p = 01	

Table 6: Blood loss and duration of 1st and 3rd stage of labor

Blood loss ml (n)	1st stage	3rd stage
< 200 (n = 128)	7.15 ± 2.66 hrs	5.16 ± 2.23 min
200-500 (n = 94)	6.91 ± 2.90 hrs	5.62 ± 2.68 min
≥ 500 (n = 28)	8.75 ± 3.06 hrs	5.43 ± 2.96 min

Time Taken for the Active Bleed to Stop

The blood loss was monitored from the beginning of 3rd stage of labor to the end of active bleed. The mean duration for the active bleed to stop was 28.5 minutes in < 200 ml blood loss group, whereas this duration was 30.6 minutes in 200-500 ml group and 41.3 minutes in \geq 500 ml group. There was statistically significant difference between these groups as shown in Table 7.

Table 7: Time taken for active bleeding to stop from the end of 3rd stage of labor

Blood loss ml (n)	Mean duration for active bleed to stop (min)
< 200 (n = 128)	28.51 \pm 4.08
200-500 (n = 94)	30.63 \pm 5.39
\geq 500 (n = 28)	41.25 \pm 13.71

The birth weight ranged from 1.76 to 3.75 kg. The mean birth weights in < 200 ml, 200-500 ml, and \geq 500 ml blood loss groups were 2.72 \pm 0.44 kg, 2.82 \pm 0.36 kg and 2.85 \pm 0.36 kg respectively. There were no statistically significant differences between the birth weights in each of these groups.

Blood Loss in Relation to 3rd Stage Complications

Out of 250 women, 161 (64.4%) women delivered without any 3rd stage complications with the mean blood loss of 181.3 \pm 109.2 ml. The mean blood loss in 42 women with 1^o perineal tear was estimated to be 243.8 \pm 140.8 ml. The mean blood loss in women with 2^o-perineal tear was 376.4 \pm 220.2 ml and 597.5 \pm 147.1 ml in women with uterine atony as shown in the Table 8.

Table 8: Blood loss in relation to tears and atony

	Mean blood loss (ml)
Nil (n = 161)	181.3 \pm 109.2
1 ^o tear (n = 42)	243.8 \pm 140.8
2 ^o tear (n = 28)	376.4 \pm 220.2
3 ^o tear (n = 1)	175 \pm 0
Cervical tear (n = 1)	590 \pm 0
Uterine atony (n = 11)	597.5 \pm 147.1
Uterine inversion (n = 1)	300 \pm 0

There were women who had combination tears, 3^o perineal tear, uterine inversion, cervical tear, and paraurethral tear. Blood loss in these women could not be compared with each other due to less sample size.

Blood Loss in Relation to Gravida (G) Status

Out of the 250 women majority were between 2nd and 3rd gravida (212/250). Though the blood loss in primigravidae was more than others, the number was too small to compare as there were only 7 primigravidae (G1 = 7, G2 = 133, G3 = 79, G4 = 26, G5 = 5). Among these primies 6/7 had associated tears/atony.

Additional Oxytocics Used in Third Stage of Labor

Among 250 women 17 women needed additional oxytocics. None of the women in < 200 ml blood loss group needed additional oxytocics. Five women in 200-499 ml group and 12 women in \geq 500 ml blood loss group needed additional oxytocics in third stage of labor as shown in the Table 9.

Table 9: Additional oxytocics

Additional oxytocics	200-499 ml group (5)	\geq 500 ml group (12)
Oxytocin 10 u	1	1
Ergometrine 0.2 mg	3	2
PGF2a	1	2
Oxytocin 20 u	0	4
Oxytocin 20 u + PGF2alfa 250	0	1
Oxytocin 20 u + PGF2alfa 250 + misoprostol 800 ug	0	1
Oxytocin 20 u + misoprostol 600 ug	0	1

Need for Blood Transfusion

Two women with blood loss >1000 ml were transfused blood. A woman who had blood loss of 1660 ml needed 2 unit of blood and another woman with blood loss of 1080 ml required 1 unit of blood.

None of the study participants had complaints of dizziness, inability to ambulate or inability to pass urine. There were no maternal mortality in this study.

DISCUSSION

Postpartum hemorrhage is the most common cause of serious blood loss in obstetrics. Studies confirm that estimated blood loss is frequently about half of the actual blood loss. Postpartum hemorrhage has traditionally been defined as an estimated blood loss exceeding 500 ml. Similarly in this study > 500 ml has been considered postpartum hemorrhage.

Blood loss can be measured by a variety of methods, each of which are cumbersome or impractical in general clinical

practice. In everyday practice, blood loss is usually estimated by subjective visual quantification, which is generally based upon prior clinical experience. A number of studies have shown that visually estimated blood loss is fraught with error.^{5,6} Modest improvements in estimation of blood loss after limited training program was found in earlier studies.⁷⁻⁹

In this study single trained person with fixed collecting container, fixed sized mops, estimation of blood spilled on flat surfaces were followed for estimation. This method detected postpartum hemorrhage in 11.2% with an average blood loss of 244.14 ± 191.81 ml. In other studies it varied from 4-24% with mean blood loss varying from 244.2 ml to 263 ml.^{10,11}

The hematological changes were studied up to 3rd day as the maximum drop in these values is found on 3rd postnatal day, the person estimating the hemoglobin and hematocrit were blinded with the blood loss. The drop in hemoglobin level in women with > 500 ml blood loss group on the third postnatal day was statistically significant compared to other groups. Similar observation was noted with hematocrit changes too. This correlated well with blood loss. Tachycardia in > 500 ml group was statistically significant at ½ hour, 1 hour and on 1st postnatal day which settled on 3rd postnatal day. There was no statistical significant difference between < 500 ml and > 500 ml group in the BP changes. Similar observations were noted in another study.¹²

A woman who had massive postpartum hemorrhage of 1660 ml was transfused 3 units and two units of blood to another woman with blood loss of 1080 ml.

There is a mixed observations with relation to blood loss and gravidity (some observed more blood loss in multigravidae whereas others in primigravidae).^{4,13-16} Present study had smaller number of primigravadaes compared to multigravidae (7 vs 243). Hence, no conclusion could be drawn.

Out of 250 women 17 women needed additional oxytocics apart from injection methylergometrine 0.2 mg which was a standard practice.

CONCLUSION

- Standardized visual method of estimation of blood loss detected blood loss > 500 ml in 11.2% of women who participated in the study.
- The hematological changes postpartum correlated well with the estimated blood loss volume.
- Standardizing visual method by using fixed collecting container and fix sized mops and training the observer improves the accuracy of estimation.

A brief educational process may assist clinicians in everyday practice to more accurately estimate blood loss and recognize patients at risk for hemorrhage related complications as appearance of clinical signs due to blood loss may be too late.

REFERENCES

1. Starr A. The safe motherhood agenda: Priorities for the next decade. New York: Interagency Group for Safe Motherhood, Family Care International; 1997.
2. Berg CJ, Atrash HK, Koonin LM, Tucker M. Pregnancy-related mortality in United States, 1987-1990. *Obstet Gynecol* 1996;88:161-67.
3. Coombs CA, Murphy EL, Laros RK Jr. Factors associated with postpartum hemorrhage with vaginal birth. *Obstet Gynecol* 1991;77:69-76.
4. Hill JA, Fadel HE, Nelson RM, Nelson GH. Blood loss at vaginal delivery. *South Med J* 1986;79(2):188-92.
5. Wallace G. Blood loss in obstetrics using hemoglobin dilution technique. *J Obstet Gynaecol Br Common* 1967;74:64-67.
6. Pastore JB. A study of the blood loss in the third stage of labor and the factors involved. *Am J Obstet Gynecol* 1936;31:78-92.
7. Luegenbiehl DL. Improving visual estimation of blood volume on peripads. *MCN Am J Matern Child Nurs* 1997;22:294-98.
8. Dildy GA, Paine AR, George NC, Velasco C. Estimating blood loss: Can teaching significantly improve visual estimation? *Obstet Gynecol* 2004;104:601-06.
9. Moscati R, Billittier AJ, Marshall B, Fincher M, Jehle D, Braen GR. Blood loss estimation by out-of-hospital emergency care providers. *Prehosp Emergency Care* 1999;3:239-42.
10. Duthie SJ, Ven D, Yung GL, Guang DZ, Chan SY, Ma HK. Discrepancy between laboratory determination and visual estimation of blood loss during normal delivery. *Eur J Obstet Gynecol Reprod Biol* 1990;38(2):119-24.
11. Prasertcharoensuk W, Swadpanich U, Lumbiganon P. Accuracy of blood loss estimation in third stage of labor. *Int J Gynaecol Obstet* 2000;71(1):69-70.
12. Robson SC, Boys, Hunter S, Dunlop W. Maternal hemodynamics after normal delivery and delivery complicated by postpartum hemorrhage. *Obstet Gynecol* 1989;74:234-39.
13. Newton M, Mosely IM, Egli GE. Blood loss during and immediately after delivery. *Obstet Gynecol* 1961;17:9.
14. Gahres EE, Albert SN, Dodek SM. Intrapartum blood loss measured with Cr54-tagged erythrocytes. *Obstet Gynecol* 1962;19:455.
15. Nelson GH, Ashford CB, Williamson R. Method for calculating blood loss at vaginal delivery. *South Med J* 1981;74:550-52.
16. Pritchard JA, MacDonald PC. Williams's Obstetrics (15th edn) Appleton Century Croft; 1976;744.