Accuracy of Visual Estimation of Blood Loss in Obstetrics Using Clinical Reconstructions

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Introduction

Postpartum hemorrhage (PPH) defined as cumulative blood loss ≥1000 mL within 24 hours of delivery, is the leading cause of maternal mortality worldwide.[1,2] Visually estimated blood loss (EBL) is often inaccurate with underestimation of high volumes, and overestimation of low volumes which can result in inappropriate resource utilization.

The aim of this IRB-exempt, observational cohort study was to study the accuracy of visual EBL in obstetrics (after a vaginal delivery (VD) and cesarean delivery (CD)). The primary outcome was to assess differences in accuracy of visual over- and underestimation of blood loss with a range of blood volumes. Secondary outcomes include assessment of differences in accuracy of visual EBL within groups and between groups; and assessment of whether vital sign variables influence estimated volumes.

Methods

Expired packed red blood cell units (hematocrit (Hct) 55-60%) were diluted with fresh frozen plasma (FFP) to obtain a Hct of 30%. With PPH defined as ≥1000 mL, blood loss scenarios were categorized as 50% (500 mL), 100% (1000 mL) and 200% (2000 mL) of a PPH volume, all with an added volume of 650 mL of FFP to represent a standard volume of amniotic fluid.

Eighteen actual blood loss scenarios were created as outlined in Table 1, and photographs (n=18) were taken of these to show participants (Images 1 and 2). Vital sign data categorized as normal (HR 80 bpm, BP 110/70 mm Hg), tachycardia and normotension (HR 110 bpm, BP 110/70 mm Hg) and tachycardia and hypotension (HR 110 bpm, BP 80/50 mm Hg) was annotated on 3 VD (all 1000 mL actual blood loss) and 3 CD (all 2000 mL actual blood loss) photographs. The clinical scenario involved a healthy 30-year old patient, G1P0 at 40 weeks gestation who had undergone a VD or CD with no risk factors for PPH. The large-format photographs were shown in random order, and participants were asked to assess EBL volume depicted in each photograph (n=24).

References

1) Lancet Glob Health 2014;2:e323-33 2) Obstet Gynecol 2017;130:e168-86

Table

Table 1. Actual and estimated blood loss volumes and distribution ratios for vaginal delivery and cesarean delivery scenarios

Actual Total Blood Loss	Blood Distribution	Visually Estimated Blood Loss (mL)	
		Vaginal delivery	Cesarean delivery
500 mL	25% in collection drape, 75% in swabs	1352 ± 448	911 ± 265
	50% in collection drape, 50% in swabs	1506 ± 416	967 ± 400
	75% in collection drape, 25% in swabs	1494 ± 355	1014 ± 228
1000 mL	25% in collection drape, 75% in swabs	2016 ± 756	1209 ± 381
	50% in collection drape, 50% in swabs*	1969 ± 609	1334 ± 350
	75% in collection drape, 25% in swabs	2131 ± 539	1400 ± 278
2000 mL	25% in collection drape, 75% in swabs	3269 ± 1610	1848 ± 655
	50% in collection drape, 50% in swabs†	3270 ± 1147	2105 ± 577
	75% in collection drape, 25% in swabs	3064 ± 876	2265 ± 397

Data shown as mean ± SD. Subset of photographs with and without annotated hemodynamic vital signs (n=3 VD*, n=3 CD†).

Images

Image 1. Vaginal delivery scenario

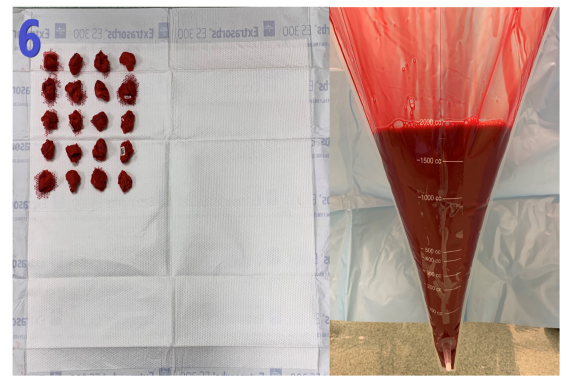

Image 2. Cesarean delivery scenario

Results

72 healthcare providers (anesthesiologists = 18, obstetricians = 18, nurses = 36) participated in the study. The mean ± SD difference between actual and EBL volume was 674 ± 443 mL (p<0.001). The mean ± SD estimates of actual 500 mL, 1000 mL and 2000 mL blood loss volumes were 1208 ± 274 mL (p<0.001), 1676 ± 388 mL (p<0.001) and 2637 ± 723 mL (p<0.001) respectively, with no differences in overestimation with increasing blood loss volumes (Table 1; p=0.415). Overestimations by group were: anesthesiologists 100%, obstetricians 88.9% and nurses 94.4% (p=0.359). The overestimated volume was 1049 ± 605 mL and 342 ± 333 mL in the VD and CD scenarios respectively (p<0.001). The distribution of blood (25/50/75% in collection drape vs. 75/50/25% in swabs) did influence overestimations (Table 1; p=0.050). Provider role and experience level did not impact EBL volume estimations.

For the 1000 mL actual blood loss VD subset with hemodynamics annotated on the photographs there was no statistically significant difference in EBL volumes with/without normal vitals (p=0.447) or with/without tachycardia and normotension (p=0.417), however the photograph annotated with tachycardia and hypotension had a greater EBL volume overestimate (165 ± 513 mL, p=0.008) than the photograph without annotated vitals.

For the 2000 mL actual blood loss CD subset, there was no statistically significant difference in EBL volumes with/without tachycardia and normotension (p=0.252) or with/without tachycardia and hypotension (p=0.063), but the photograph annotated with normal vitals had a greater EBL volume overestimate (107 ± 383 mL, p=0.020) than the photograph without annotated vitals.

Discussion

Almost all providers significantly overestimated blood loss (by nearly 700 mL), with overestimates even greater in VD. Surprisingly, EBL was not influenced by actual blood loss volume, actual blood loss distribution or provider factors. Hemodynamics only impacted estimations if hypotension was introduced, although tachycardia is a known better predictive vital sign change. This study confirms how poor EBL estimates are, and fails to identify modifiable influencing factors. Findings confirm that objective measures of blood loss are needed.