

## CUMULATIVE QUANTITATIVE ASSESSMENT OF BLOOD LOSS

Audrey Lyndon, PhD, RNC, FAAN, University of California, San Francisco

Jennifer McNulty, MD, Long Beach Memorial Hospital

Bev VanderWal, MN, RNC-OB, Spectrum Health Grand Rapids, MI

Kristi Gabel, MSN, RNC-OB, C-EFM, Perinatal CNS, Sutter Roseville Medical Center

Valerie Huwe, MS, RNC-OB, CNS, University of California, San Francisco; El Camino Hospital

Elliott Main, MD, California Maternal Quality Care Collaborative, California Pacific Medical Center

### EXECUTIVE SUMMARY

- Measuring blood loss as accurately as possible is essential to identifying and responding to hemorrhage.
- Visual estimation significantly underestimates large volumes by 35-50%.
- Estimation can be improved with training, but skills decay over time.
- Measurement via calibrated drape correlates with photospectrometry values.
- Routine quantification of blood loss with standardized processes is strongly recommended for all births.

### BACKGROUND AND LITERATURE REVIEW

Accurate measurement of blood loss is essential for 1) recognizing potentially life-threatening hemorrhage and 2) managing blood product replacement. While multiple methods for estimating blood loss are available, most are either impractical (e.g., acid hematin; chromium tagged RBCs) or inaccurate (e.g., visual estimation).<sup>1,2-5</sup> Visual estimation has consistently been shown to significantly underestimate large volume blood loss by 33%-50% when compared to direct measurement.<sup>2-6</sup> Visual estimation of blood loss may also be complicated by the presence of a large volume of amniotic fluid, stool or sponges. Several studies demonstrate that while visual estimation of blood loss is inaccurate, especially for larger volumes, it can be improved with training and by quantification of blood loss using calibrated under-buttocks drapes to collect blood.<sup>2-5,7</sup> However, training to improve visual estimation has also been shown to deteriorate over time.<sup>8</sup> Moreover, measurement of blood loss by calibrated drape at vaginal birth was highly correlated with photospectrometry values.<sup>9,10</sup> Replacing estimation with quantification of blood loss at birth has been proposed as one of seven safety objectives of the National Maternal Health Initiative.<sup>11</sup> We recommend routine quantification of blood loss (QBL) at all births as a best practice.

Challenges in implementing routine QBL may include clinician's concerns for the workflow changes involved in routine QBL and desire to reserve QBL for the severe hemorrhage. Clinicians may also be concerned that QBL will not provide an exact quantification, especially in cases where there is a lot of amniotic fluid or irrigation.

Rationale for routine quantification: Delay in recognition of large blood losses is a common finding in cases of maternal morbidity and mortality from hemorrhage and a policy of waiting to quantify blood loss only after the excessive loss is appreciated does not address this problem.<sup>12,13</sup> Standardization of procedures is an important aspect of improving safety and quality, and if QBL is used only for severe cases, staff may be unfamiliar with the procedures and less likely to obtain valid data. With practice and routine adoption, quantification of blood loss generally requires only minutes to perform in the majority of births.<sup>14</sup> Standardization of the processes involved, and building the experience of team members through obtaining this measure in all routine cases develops the skills needed to quantify blood loss in an actual hemorrhage situation. The purpose of quantification of blood loss is not to obtain an "exact" number as there will always be a degree of imprecision of this measurement. Instead, the goal is to improve evaluation of large blood losses compared to estimation techniques, which are known to be inaccurate. QBL is meant to promote early recognition of large volume blood loss and is just one component of an overall strategy to facilitate effective response to hemorrhage.

Average amniotic fluid volumes have been described across gestational ages from 8-43 weeks and can be approximated using a published nomogram when necessary.<sup>15</sup> The specific materials used to collect blood and the presence of clots may also affect accuracy of blood loss measurement.<sup>10</sup> Measurement of blood loss by weight is the most accurate and practical method for determining the volume of blood not captured in graduated containers. This can be accomplished by subtracting the dry weight of absorbing materials (pads, sponges, etc.) from the weight of blood-containing materials and using the conversion 1 gm weight = 1 mL to quantify the blood volume contained in the materials. Use of simple applications, such as a calculator embedded within an electronic medical record or a spreadsheet which includes standard dry weights for any items used during cesarean or vaginal birth, can facilitate easier determination of quantified blood loss.

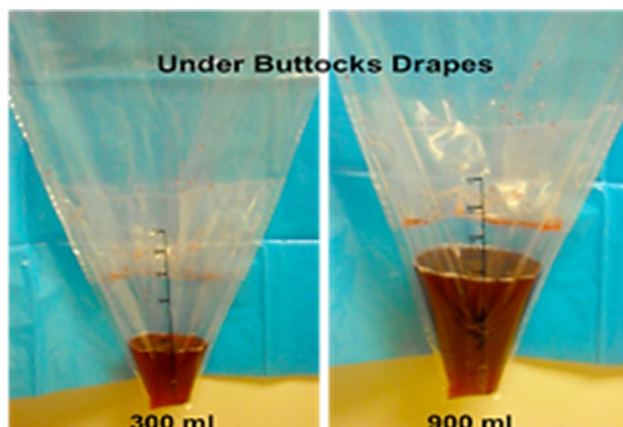
## RECOMMENDATIONS

1. All facilities provide chart tools and **regularly scheduled standardized training** in formal quantitative measurement of blood loss, which is critical for early recognition of and response to maternal hemorrhage. (Level I B)
2. Quantitative measurement of blood loss should be a collaborative effort that includes nurses, anesthesia and obstetric providers.

3. For vaginal birth:
  - a. Use under-buttock drapes, preferably with graduated markers, to collect blood with vaginal birth. (Level I B)
  - b. Immediately after the birth of the baby, stop to assess the amount of fluid in the under-buttock calibrated drape. This value becomes the 'baseline' and all subsequent fluid represents blood loss.
  - c. At the completion of the delivery/recovery period weigh all blood clots and blood soaked materials to determine cumulative volume. See Appendices I, J and K for supporting material.
4. For cesarean birth:
  - a. After birth of the baby, suction all amniotic fluid and stop to assess the amount of collected fluid before delivery of the placenta. This value is the 'baseline'. All subsequent fluid represents blood loss (except use of measured irrigation fluid volume).
  - b. In addition to counting lap sponges, the circulating nurse should assess volume of blood loss by weight or saturation assessment techniques
5. For birth without prior rupture of membranes, the following volumes can be used to estimate the contribution of amniotic fluid at term: Brace, et al. found normal fluid volume 700 mL; oligohydramnios 300 mL; polyhydramnios 1400 mL. (Level III A)<sup>15</sup>
6. Unusual visual and auditory cues to excessive bleeding should be urgently investigated. Such cues include blood on the floor, walls, or ceiling, blood dripping off of the bed, table, or stretcher, continuously vibrating suction tubing or continuous full suction. (Level III C)
7. **For all cases of ongoing hemorrhage, intake and output measurements should be** documented, tallied, and reported to the team at frequent intervals. (Level III C) This data provides important direction to the team.
8. Trigger tools such as the **NHS Obstetric Early Warning Chart** (Appendix E, printed with permission Fiona McIlveney, PhD) should be used for all women to assist staff in recognizing and responding to concealed hemorrhage.<sup>16,17</sup> (Level III C)

## EDUCATIONAL TOOLS, SAMPLE DOCUMENTS

1. **Posters** with volumes collected on materials commonly used in Labor and Delivery, **Techniques for Ongoing Quantitative Assessment of Blood Loss** (Appendix F) (L&D)<sup>2</sup>



(Photos courtesy of Bev VanderWal, and used with permission)

2. **Gram scales** readily available in US L&D settings:
  - a. Blood soaked materials should be placed in precautionary container system, such as red-bagging, but kept accessible during an acute bleed to allow a visual cue to blood volume loss and to facilitate resolution of any discrepancies in blood volume loss assessment. (Level III C)
  - b. Dry weight of materials must be subtracted from weight of blood soaked materials. The best technique for accounting for dry weight may depend on the circumstances and volume of material. Strategies include:
    - i. Zeroing the scale with comparable dry material
    - ii. Subtracting known weight of dry materials from the total weight
  - c. Facilities should keep an updated list of standard dry weights for materials available in-patient care areas.
3. **Under-buttocks calibrated drapes** with measurement marks on collection pouches

**United States Manufacturer: Medline**

[www.medline.com](http://www.medline.com)

**Product pdf: surgical gowns and drapes:**

[http://www.medline.com/international/lit/european%20catalog/english/proxi\\_ma\\_english.pdf](http://www.medline.com/international/lit/european%20catalog/english/proxi_ma_english.pdf)

4. **Simulations and Drills of OB Hemorrhage:** Blood-red-colored cloth (challis fabric or synthetic silk works well; 3 yards) used during drills and simulations in lieu of imitation blood is recommended; it works effectively as a visual cue, is easy to transport and requires no clean-up. Tuck the fabric into the mannequin's pelvis with one corner hanging out onto the bedsheets/chux; an actor in the simulation then pushes/pulls the rest of the cloth out of the pelvis as the hemorrhage continues. See Appendices B and C for supporting materials on drill and debriefing.
5. See Emergency Management Plan, Checklist Format for approximate volumes for blood product replacements
6. Template for trigger tool such as *NHS Obstetric Early Warning Chart*, Appendix E.

## EVIDENCE GRADING

**Level of Evidence: I B.** Evidence obtained from at least one properly designed randomized controlled trial. Recommendations based on limited or inconsistent evidence.

**Level of Evidence: III A.** Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees. Recommendations based on high quality and consistent evidence.

**Level of Evidence: III C.** Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees. Recommendations based primarily on consensus and expert opinion.

## REFERENCES

1. Kodkany B, Derman R. *Pitfalls in assessing blood loss and decision to transfer*. Sapiens Publishing; 2006.
2. Bose P, Regan F, Paterson-Brown S. Improving the accuracy of estimated blood loss at obstetric haemorrhage using clinical reconstructions. *BJOG*. 2006;113:919-924.
3. Patel A, Goudar SS, Geller SE, et al. Drape estimation vs. visual assessment for estimating postpartum hemorrhage. *Int J Gynaecol Obstet*. Jun 2006;93(3):220-224.
4. Dildy G, Paine A, George N, Velasco C. Estimating blood loss: Can teaching significantly improve visual estimation? *Obstet Gynecol*. 2004;104(3):601-606.
5. Toledo P, McCarthy RJ, Hewlett BJ, Fitzgerald PC, Wong CA. The accuracy of blood loss estimation after simulated vaginal delivery. *Anesth Analg*. 2007;105:1736-1740, Epub 2007/1711/1729.
6. Al Kadri HM, Al Anazi BK, Tamim HM. Visual estimation versus gravimetric measurement of postpartum blood loss: a prospective cohort study. *Arch Gynecol Obstet*. Jun 2011;283(6):1207-1213.

7. Toledo P, McCarthy RJ, Hewlett BJ, Fitzgerald PC, Wong CA. The accuracy of blood loss estimation after simulated vaginal delivery. *Anesth Analg*. Dec 2007;105(6):1736-1740.
8. Toledo P, Eosakul ST, Goetz K, Wong CA, Grobman WA. Decay in blood loss estimation skills after web-based didactic training. *Simulation in healthcare : journal of the society for simulation in healthcare*. Feb 2012;7(1):18-21.
9. Prasertcharoensuk W, Swadpanich U, Lumbiganon P. Accuracy of the blood loss estimation in the third stage of labor. *Int J Gynaecol Obstet*. Oct 2000;71(1):69-70.
10. Patel A, et al. Blood loss: accuracy of visual estimation in A Textbook of PostPartum Hemorrhage. (ed C. B-Lynch et al.) *Sapiens Publishing*. 2006.
11. Conry JA. Every woman, every time. *Obstet Gynecol*. Jul 2013;122(1):3-6.
12. Della Torre M, Kilpatrick SJ, Hibbard JU, et al. Assessing preventability for obstetric hemorrhage. *American journal of perinatology*. Dec 2011;28(10):753-760.
13. Goswami D, Rathore AM, Batra S, Dubey C, Tyagi S, Wadhwa L. Facility-based review of 296 maternal deaths at a tertiary centre in India: Could they be prevented? *J Obstet Gynaecol Res*. Dec 2013;39(12):1569-1579.
14. ACOG. ACOG Committee Opinion No. 526: Standardization of practice to improve outcomes. *Obstet Gynecol*. 2012;119(5):1081-1082.
15. Brace RA, Wolf EJ. Normal amniotic fluid volume changes throughout pregnancy. *Am J Obstet Gynecol*. Aug 1989;161(2):382-388.
16. Harrison P, et al. Early warning scoring in obstetrics. *Intern J Obstetric Anesthesia Abstracts of free papers presented at the annual meeting of the Obstetric Anaesthetists Association Glasgow, May 11-12, 2008*. 2005;15(Supplement):S1-S43.
17. Swanton R, Al-Rawi S, Wee M. A national survey of obstetric early warning systems in the United Kingdom. *Intern J Obstetric Anesthesia*. 2009;18(3):253-257.