BLOOD LOSS: CLINICAL TECHNIQUES FOR ONGOING QUANTITATIVE MEASUREMENT

Audrey Lyndon, PhD, CNS, RNC, Department of Family Health Care Nursing, University of California, San Francisco; Suellen Miller, PhD, CNM, MHA, Department of Obstetrics, Gynecology and Reproductive Sciences, University of California, San Francisco; Valerie Huwe, RN, BSN, El Camino Hospital; Mark Rosen, MD, Department of Anesthesia, University of California, San Francisco; David Lagrew, MD, Saddleback Memorial Medical Center; Patricia Dailey, MD; Anesthesiology, Mills Peninsula Health Services; Elliott Main, MD, Department of OB/GYN, California Pacific Medical Center, Sutter Health

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). (1-5) Visual estimation of blood loss volume is inaccurate and can underestimate postpartum blood loss by 33%-50% when compared to the gold standard for quantifying blood loss, which is photospectrometry or colorimetric measurement of alkaline hematin in blood. (3) 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. (2-5) Average amniotic fluid volumes have been described across gestational ages from 8-43 weeks and can be approximated using a published nomogram when necessary. (6) The specific materials used to collect blood and the presence of clots may also affect accuracy of blood loss measurement. (7) 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.

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) Examples are provided in attachments.

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. When clinicians first note excessive bleeding (more than 500 ml of quantified blood loss), weigh all blood soaked materials to determine cumulative volume and evaluate sizes of blood clots. (Examples of chart tools to assist this process are provided).
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 (see tools).
5. For birth without prior rupture of membranes, the following volumes can be used to estimate the contribution of amniotic fluid at term: Bragg et al found normal fluid volume 700 mL; oligohydramnios 300 mL; polyhydramnios 1400 mL. (Level III A) (6)
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** (attached; printed with permission Fiona McIlveney, PhD) should be used for all women to assist staff in recognizing and responding to concealed hemorrhage. (Level III C)

EDUCATIONAL TOOLS, SAMPLE DOCUMENTS

1. **Posters** with volumes collected on materials commonly used in Labor and Delivery (L&D) (2)
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
   Product .pdf: surgical gowns and drapes:
   http://www.medline.com/international/lit/european%20catalog/english/proxima_english.pdf

   International Manufacturer:
   Excellent Fixable Drapes
   Plot No. 4, Thai Moogambigai Nagar
   K. Pudur
   Madurai 625 007 TN
   India
   excellentfixabled@hotmail.com
   +91 (452) 256 8495
   Name of Drape: BRASSS-V Drape

4. **Skills Stations: Measuring Blood, Use of Simulated Blood:** Use of Powdered Blood (from Simulaids: http://www.simulaids.com; phone: 800-431-4310; item #225) is recommended for use in training skills station and in some drill or simulation settings. Recipes for simulated blood made from household-based ingredients are listed below; however, note that sugar-based simulated blood is a source of bacterial growth, is difficult to clean-up and should only be used in a skills station setting, **not** in a L&D room drill or simulation or with a mannequin. Blue dishwashing soap instead of food coloring can be used to thicken the simulated blood or give it a darker color. Because the mannequins are not stained, clean up is easier.
   Simulated Blood Clots: clumps of corn starch can be used to simulate blood clots; or parts of gauze sponges or anything to give the appearance of a clot. Some groups have used jello or “jello-jigglers”; however, bacterial growth and staining should be considered with these options.

a. Imitation Blood Recipe #1:
   - 1 cup Karo Syrup
   - 1 tablespoon Water
   - 2 tablespoons Red Food Coloring
   - 1 teaspoon Yellow Food Coloring

b. Imitation Blood Recipe #2:
   - 2 cups corn syrup
   - 1 cup water
   - 10 tablespoons maize flour
   - 10 teaspoons red food coloring
   - 10 drops blue food coloring

5. **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.

6. Template with approximate volumes for blood product replacements
7. Template for trigger tool such as ***NHS Obstetric Early Warning Chart*** **(attached)** (8, 9)
8. OB Hemorrhage Report Template (attached)
9. Example "SBAR" (Situation-Background-Assessment-Recommendations) communications regarding QBL

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.

Your Hospital Logo Here

OB HEMORRHAGE REPORT [TEMPLATE]

Initiate at Stage 1:
Blood loss >500 ml vaginal, 1000 ml cesarean OR Vital Signs >15% change or HR ≥110, BP ≤85/45, O2 Sat <95% OR Increased bleeding during recovery, postpartum

Patient Addressograph

MD Team Names	Notified Time	Arrival Time	Date	Unit
			History:	

		Time (HR:Min)	Time (HR:Min)	Time (HR:Min)	Time (HR:Min)	Time (HR:Min)	Time (HR:Min)	Time (HR:Min)	Time (HR:Min)	Time (HR:Min)	Time (HR:Min)
VITAL SIGNS	HR										
	BP										
	RR										
	O2 sat										
	EBL										
	Mental status										
	Urine output										
	Pain										
MEDICATIONS	Methergine										
	Hemabate										
	Misoprostol										
	Pain meds										
IV & BLOOD PRODUCTS	LR										
	NS										
	Oxytocin IV drip										
	RBCs										
	FFP										
	PLTS										
	CRYO										
LABS (note time drawn & results time)	Hemacue										
	Hct/Hgb										
	Platelets										
	PT/PTT										
	Fibrinogen										
	ABG										
PROC EDUR	Uterine balloon, Embolization, X-ray, Ultrasound, etc.										

Outcome	Disposition
Primary nurse R.N.	Other nurses
Team Leader (MD) Note:	
	MD Signature

White copy – Chart
Yellow copy – Nurse manager

Page ____ of _____

OB HEMORRHAGE REPORT
Measuring Blood Loss

Patient Addressograph

Item (Hospital Specific)	Approx Dry Weight (grams)	"Wet" weight (grams)	Wet weight minus Dry weight = Milliliters (ml) of fluid/blood (may have multiple items)	Total per category
Blue Chux	35			
Kendall Curity Maternity Pads®	14			
Maxithins®	11			
Cloth soaker pad	465			
Dry lap sponge (large)	22	"Soaked" lap = 80 gms → "Partially wet" lap = 50gms →	Approx. 60ml blood Approx. 30ml blood	
Dry lap sponge (small)	14			
Graduated container volume	Estimated amniotic fluid volume_____ Irrigation fluid volume_____ Non Blood SubTotal_____		Container #1 _____ Container #2 +_____ Less non-Blood-_____	
			TOTAL ESTIMATED BLOOD LOSS (ml)	

EXAMPLE

Item	Approx Dry Weight (gms)	"Wet" weight (grams)	Wet weight minus Dry weight = Milliliters of fluid/blood	Total per category
Blue Chux	35	135 (- 35 =)	100 ml	100 ml
Kendall Curity Maternity Pads®	14			
Maxithins®	11	26 + 31 = 57 (- 22 =)	35 ml	35 ml
Cloth soaker pad	465			
Dry lap sponge (large)	22	"Soaked" lap = 80 gms → "Partially wet" lap = 50gms →	Approx. 60ml blood x 15 = 900ml Approx. 30ml blood x 20 = 600ml	1500 ml
Dry lap sponge (small)	SAMPLE			
Graduated container volume	Container volume minus estimated amniotic fluid volume		Container #1 _____ Container #2 _____ Container #3 _____	
			TOTAL ESTIMATED BLOOD LOSS (ml)	1635 ml

REFERENCES

1. Kodkany B, Derman R. Pitfalls in assessing blood loss and decision to transfer in A Textbook of PostPartum Hemorrhage. (ed C B-Lynch et al) Sapiens Publishing 2006 2006.
2. Bose P, Regan F, Paterson-Brown S. Improving the accuracy of estimated blood loss at obstetric haemorrhage using clinical reconstructions. BJOG 2006;113:919-24.
3. Patel A, Goudar SS, Geller SE, Kodkany BS, Edlavitch SA, Wagh K, et al. Drape estimation vs. visual assessment for estimating postpartum hemorrhage. Int J Gynaecol Obstet 2006 Jun;93(3):220-4.
4. Dildy G, Paine A, George N, Velasco C. Estimating Blood Loss: Can Teaching Significantly Improve Visual Estimation? Obstet Gynecol 2004;104(3):601-6.
5. Toledo P, McCarthy R, Hewlett B, Fitzgerald P, Wong C. The accuracy of blood loss estimation after simulated vaginal delivery. Anesth Analg 2007;105:1736-40.
6. Brace RA, Wolf EJ. Normal amniotic fluid volume changes throughout pregnancy. Am J Obstet Gynecol 1989 Aug;161(2):382-8.
7. Patel A, et al. Blood loss: accuacy of visual estimation in A Textbook of PostPartum Hemorrhage. (ed C B-Lynch et al) Sapiens Publishing 2006 2006.
8. 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.
9. Swanton R, Al-Rawi S, MYK W. A national survey of obstetric early warning systems in the United Kingdom. Intern J Obstetric Anesthesia 2009;18(3):253-57.