Estimation of blood loss is inaccurate and unreliable

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Background. *To determine the characteristics associated with improved accuracy or reliability of estimating operative blood loss.*

Methods. *Operating room personnel at a tertiary care hospital evaluated 3 operative simulations and provided estimations of blood loss. The simulations utilized precise, known volumes of porcine blood and saline on tapes, sponges, and in suction containers. Low volume (50 mL), mid volume (300 mL), and high volume (900 mL) blood loss scenarios were used in this simulation. Information collected included the blood loss estimation, the participant's occupation, years of experience in the operating room, confidence level in estimating blood loss, and their opinion as to which group would provide the most accurate estimation.*

Results. *Sixty practitioners participated: 17 anesthesia providers, 22 surgeons, and 21 nurses and technicians. Overall, estimations were significantly inaccurate: scenario 1, mean error 52%; scenario 2, mean error 61%; scenario 3, mean error 85%. Ninety-five percent of participants provided estimations that had >25% error in at least 1 scenario. Only 27% demonstrated consistency in over or under-estimating the blood loss. There was no association between specialty, years of experience, or confidence in ability with consistency or accuracy of estimating blood loss.*

Conclusion. *This study demonstrates that visual estimation of operative blood loss is unreliable and inaccurate. No provider specialty, level of experience, or self-assessment of ability was associated with improved estimation. Blood loss estimations are not a reliable metric to judge physician performance or patient outcomes. Consideration should be given to alternative reporting of operative blood loss to better direct perioperative care. (Surgery 2016;160:946-53.)*

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Estimated operative blood loss (EBL) is used to guide perioperative care and as a quality marker. Previous studies, however, have found this estimation to be inaccurate.[1-9] Despite this, EBL is regarded as a critical metric, including mandatory reporting in the brief operative note by the Joint Commission.[10]

At our institution, a level I urban trauma center and quaternary referral center, EBL is determined by consensus of operating room personnel using visual estimation throughout and at the conclusion of an operation. All suction canisters, gauze, and drapes are made available for inspection by the operating team to create their estimation.

This study was designed to identify characteristics of operating room personnel or conditions associated with improved accuracy or reliability of blood loss estimation. We hypothesized that more experience in the operating room as well as the provider's role would correlate with more accurate or at least more reliable EBL. We also hypothesized that providers may give better estimations with low volumes of blood. To test these ideas, we created a simulation with the purpose of identifying the appropriate team members to charge with this important responsibility.

METHODS

Three scenarios were generated using precise, known volumes of porcine blood and saline on gauze (tapes and sponges), and in transparent suction canisters. All materials were identical to those used in the operating room, including suction containers with volume labels marked as per manufacturer design. Participants were provided with a written, brief description of the operation associated with each scenario (Appendix A). They were

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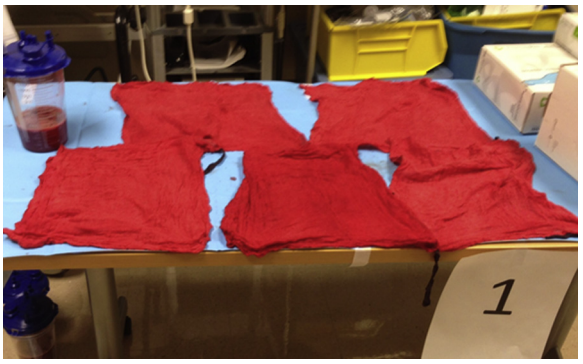

Fig 1. Scenario 1: 300 mL of blood and 200 mL saline irrigation. This scenario used 5 saturated laparotomy pads (200 mL blood) and a partially filled suction container containing 100 mL blood and 200 mL saline.

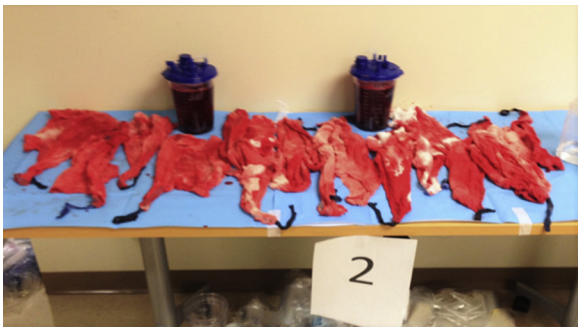

Fig 2. Scenario 2: 900 mL of blood and 2,000 mL saline irrigation. These volumes were mixed between 15 laparotomy pads (300 mL blood and 600 mL saline) and 2 suction containers. One suction contained 200 mL blood and 800 mL saline, and the other contained 400 mL blood with 600 mL saline.

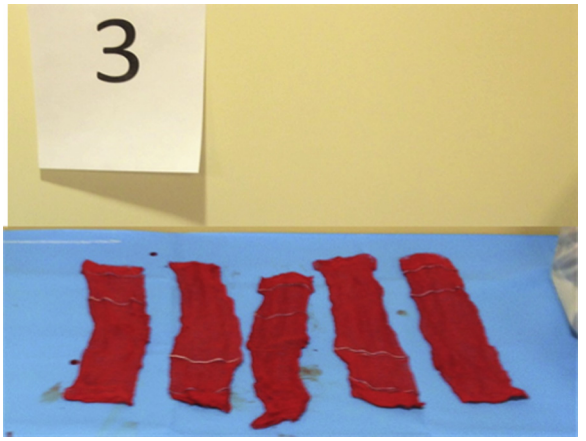

Fig 3. Scenario 3: 50 mL of blood without irrigation. Five Ray-Tek (Johnson and Johnson, New Brunswick, NJ) sponges were saturated for this simulation.

instructed to assume that then entire EBL was present in the scene with no additional blood on the floor, gowns, drapes, or otherwise lost. They were permitted to interact with each scene as they chose, including handling all materials. No time limit was placed on this interaction. A proctor was present to assure consistency of each scenario, although no guidance was provided to participants.

Participants were recruited through fliers and announcements. Invited providers included surgery attendings and residents (surgery); anesthesia attendings and residents, anesthesia assistants (AA), and certified registered nurse anesthetists (CRNA; anesthesia); circulating nurses and surgical scrub technicians (nursing). These groups were chosen because they all have a role in providing the final EBL at our institution. Exclusion criteria were failure to complete the postsimulation survey. This study was approved by the MetroHealth Medical Center Institutional Review Board and written, informed consent was obtained from all participants.

The scenarios we used were created to simulate low, mid, and high volume blood loss. Hypothetical cases were written to offer context to the volumes of blood loss and irrigation used, although the other details of the cases were stated explicitly to be inconsequential to the simulation. The low volume scenario (3) had 50 mL of porcine blood on 5 gauze sponges. The mid volume scenario (1) had 300 mL of blood and 200 mL saline irrigation (5 laparotomy pads and a partially filled suction container). The high volume scenario (2) had 900 mL of blood and 2,000 mL saline irrigation (15 laparotomy pads and 2 suction containers; Figs 1–3). Volumes of blood loss were chosen to represent quantities that may be commonly seen in various operations and would be relatable to the volumes used in blood transfusions (300 mL = 1U packed red blood cells (PRBC), 900 mL = 3U PRBC), as well as a low but measurable volume (50 mL). Participants were able to record their EBL for each scene as they interacted with them.

At the conclusion of the simulation, participants were asked to complete a survey asking the participant's occupation, years of experience in the operating room, confidence level in estimating blood loss, and their opinion as to which group would provide the most accurate estimation of blood loss.

Statistical analysis was carried out using Microsoft Excel (Microsoft Corporation, Redmond, WA). Data were compared using unpaired *t* tests.

RESULTS

Sixty-four participants completed the simulation, with 4 excluded for providing incomplete data collection forms. Sixty participants were therefore included in our analysis: 17 anesthesia providers (7 attendings, 6 residents, and 4 AAs/CRNAs), 21