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CORRESPONDENCE

Comparison of point-of-care hemoglobin meters in anemic patients in perioperative and critical care settings

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To the Editor,

While validated measures such as the complete blood count and arterial blood gas analysis are currently the gold-standard, results may take up to 45 min to obtain, during which time a rapidly deteriorating patient's status may have changed, rendering the results irrelevant. This becomes especially problematic in the setting of severe anemia where a clinician must decide whether a blood product transfusion should be performed, incurring the potential risks of organ dysfunction, increased hospital length of stay, immunomodulation, alloimmunization, transfusion reactions, thromboembolism, and death.[1] Point-of-care and indirect testing of hemoglobin has been proposed as a means of improving patient care in the perioperative and critical care environment.

In recent years, different hemoglobin point-of-care-testing (POCT) devices have emerged, with varied mechanisms of action. EPOC (Epocal Inc., Ottawa, ON, Canada) and i-STAT (Abbott Point of Care Inc., East Windsor, NJ, USA) record a hematocrit and mathematically convert this to hemoglobin. EPOC and i-STAT offer the advantage of also being able to measure blood gases in addition to hemoglobin. Craver *et al.* reported that patients whose anemia was evaluated using a hematocrit were more likely to receive a blood transfusion, have longer hospital stays, and greater costs associated with care.[2] Alternatively, HemoCue (HemoCue, Ängelholm, Sweden) directly hemolyses erythrocytes and uses photometry to report hemoglobin. There is insufficient information to recommend the use of one device over another. There are currently no recommendations regarding limitations on point-of-care devices, and clinicians are left to evaluate and choose the device that best suits their needs. We performed a comparison study to determine which of these three popular hemoglobin POCT devices was more accurate in measuring hemoglobin in anemic patients compared with the laboratory value.

This study was conducted at the Regina General Hospital and was approved by the Research Ethics Board of the Saskatchewan Health Authority (May 8, 2018: REB-18-17). Fifty-eight adult (> 18 yr old) patients with a central venous or arterial line who recorded a hemoglobin level less than 100 $g{\cdot}L^{-1}$ by the hematology laboratory were enrolled in the study. All hemoglobin readings were obtained simultaneously within a 20-min time window, and were all done within a two-hour time frame of the blood collection. All three samples recorded were then compared with the gold-standard hematology laboratory analyzer value.

Bland–Altman analysis for HemoCue showed a bias of 1.73 and limits of agreement of −8.44 to 11.91. EPOC showed a bias of −11.37 and limits of agreement of −50.07 to 27.34. i-STAT showed a bias of 2.41 and limits of agreement of −30.61 to 35.44 (Figure A, B, and C). Deming regression analysis of HemoCue displayed a coefficient correlation of 0.8403, a −1.8 bias (−2.1%), and a standard deviation of 5.1. EPOC showed a coefficient correlation of −0.0896, bias of 11.6 (12.8%), and standard deviation of 19.5. i-STAT showed a coefficient correlation of −0.169, bias of −1.3 (−1.6%), and standard deviation 18.3.

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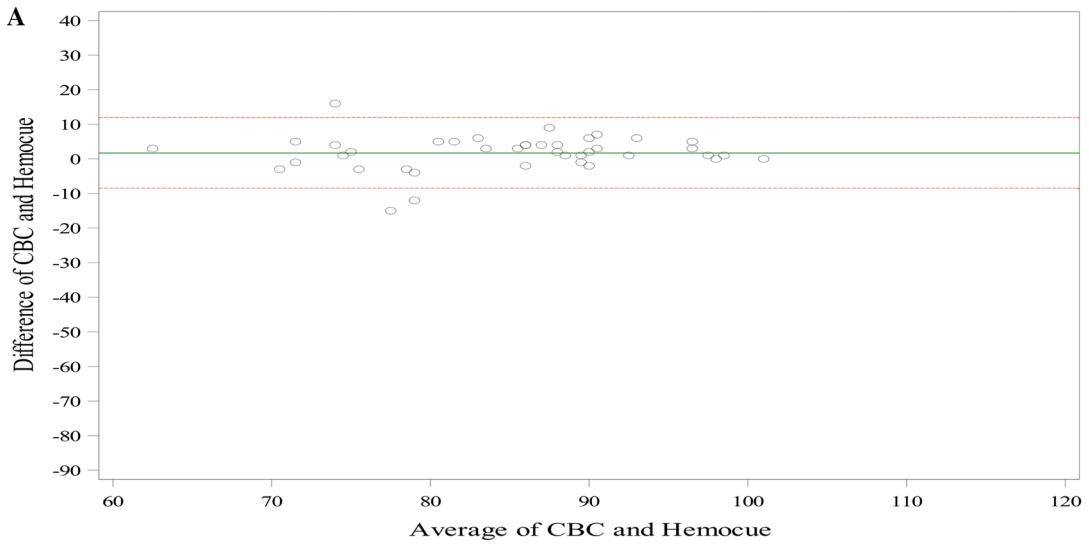
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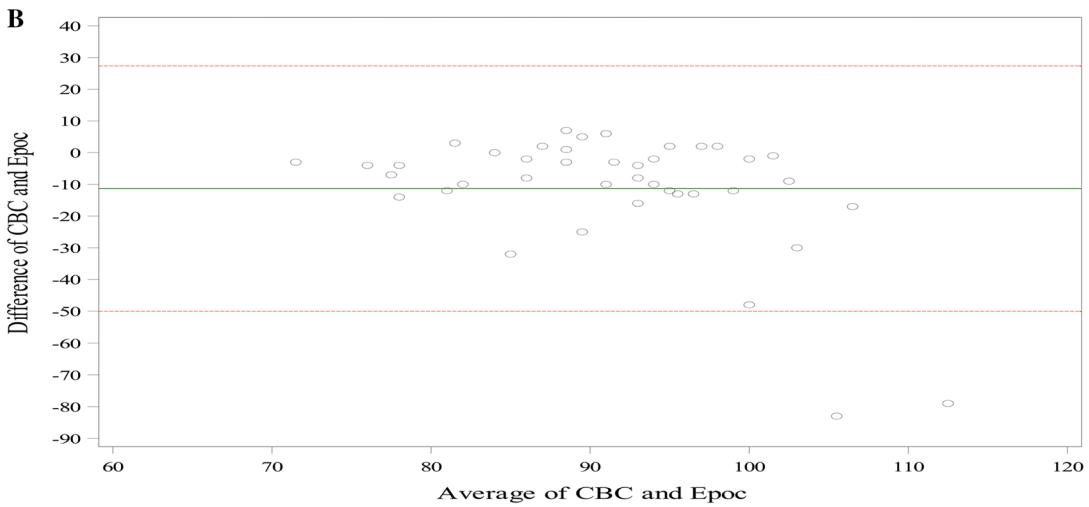
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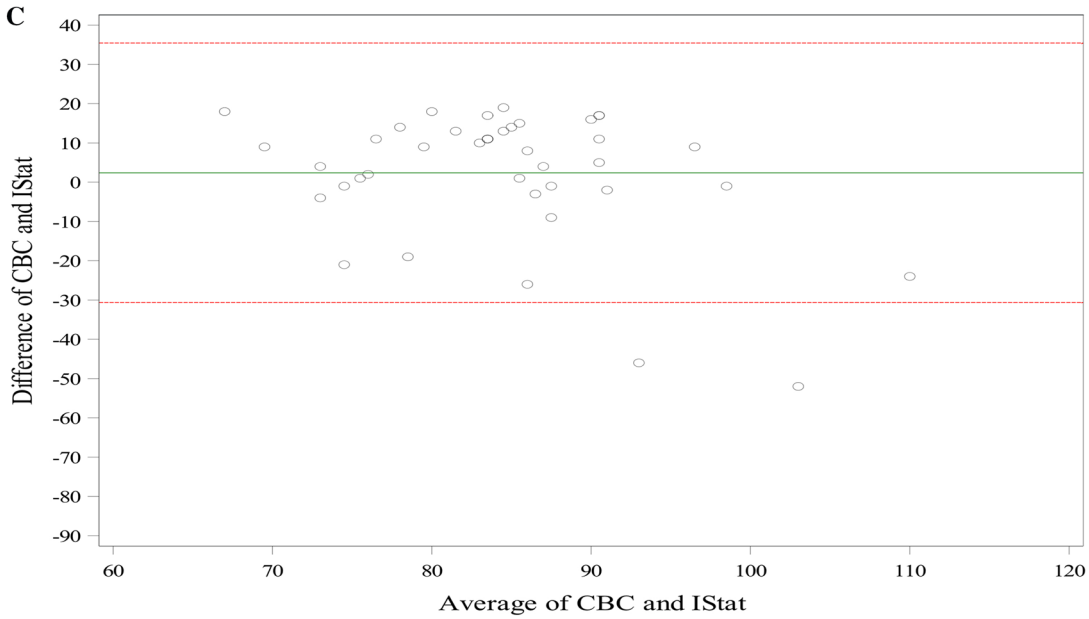
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Average of CBC and IStat

◀ **Figure** A) Bland–Altman plots comparing point-of-care hemoglobin estimates from HemoCue, B) EPOC, and C) i-Stat devices with laboratory hemoglobin standard

Since the landmark TRICC trial by Hébert *et al.,* clinicians have followed a more restrictive transfusion protocol, where transfusion is recommended at hemoglobin concentrations below 70 $g{\cdot}L^{-1}$, and hemoglobin concentration should be maintained between 70 $g{\cdot}L^{-1}$ and 90 $g{\cdot}L^{-1}$.[3] Our study found that, at this range, HemoCue had a stronger correlation to the hematology laboratory analyzer than EPOC and i-STAT and is the most accurate point-of-care testing device for hemoglobin.

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Conflicts of interest None declared.

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