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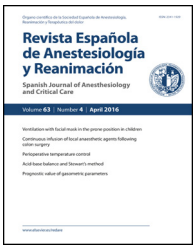

ORIGINAL ARTICLE

Is a blood sample for hemoglobins in the transfusional range reliable?☆

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KEYWORDS
Hematocrit;
Hemoglobin;
Point-of-care systems

Abstract
Objective: To evaluate the correlation and agreement in our unit and population of hemoglobin in gasometry versus hematology analyzer, to evaluate errors in transfusion or lack thereof.
Results: strong association between Point-of-care (POC) and hematimetry, with $P < .001$, with a coefficient of determination r^2 of 0.56, an intraclass correlation coefficient of 0.63 and a Lin's concordance correlation coefficient of 0.65. For hemoglobins less than 7 g/dL, a success rate of 29.41% was obtained.
Conclusions: Low-moderate agreement of POC hemoglobin with standard haemothymetry. High probability of errors in the indication of transfusion based on gasometer hemoglobins, especially in low hemoglobins.

PALABRAS CLAVE
Hematocrito;
Hemoglobina;
Sistemas point-of-care

¿Es fiable una muestra de gasometría para hemoglobinas en rango transfusional?

Resumen
Objetivo: Evaluar la correlación y la concordancia en nuestra unidad y en la población de la cifra de hemoglobina en gasometría versus hematimetría estándar; valorar errores en transfusión o falta de la misma.

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Resultados: Fuerte asociación entre los resultados del gasómetro (POC) y la hematimetría, con $p < 0{,}001$, con un coeficiente de determinación r^2 de 0,56, un coeficiente de correlación intraclase de 0,63 y un coeficiente de correlación de Lin de 0,65. Valores similares para el hematocrito. Para hemoglobinas menores de 7 g/dl se obtiene una tasa de acierto del 29,41%.
Conclusiones: Concordancia baja-moderada de la hemoglobina del POC con la hematimetría estándar. Alta probabilidad de errores en la indicación de transfusión en base a hemoglobinas de gasómetro, sobre todo en hemoglobinas bajas.

Introduction

During a stay in the ICU, a patient will typically lose more than 700 ml of blood for lab tests alone.[1] In a critically ill patient, frequent blood sampling for diagnostic purposes is essential, and up to 944 ml can be drawn.[1] This is equivalent to losing 1 bag of packed red blood cells (PRBC) every 7–10 days. Arterial blood gas (ABG) testing is often performed to reduce blood loss and laboratory waiting times. This is a quick test that requires a smaller sample and shows the acid-base balance, haemoglobin (Hb) levels and electrolytes.

Validated ABG analysis techniques have been available for many years.[2] However, Maslow et al.[3] raised concerns about the important clinical differences and limitations found in the 3 point-of-care (POC) tests evaluated in their study, and warned clinicians not to rely on these data as sole determinants of when to perform transfusion. In critical care, the most frequent cause of transfusion (up to 72% of patient) is low Hb.[4]

The aim of this study has been to evaluate the correlation and concordance in our unit and patient population between Hb levels from a POC ABG device and from central laboratory tests (CLT), and to evaluate the extent to which sole reliance on POC Hb levels can lead to errors in administering or failing to administer blood transfusions.

Material and method

This was a retrospective study in patients admitted to the surgical intensive care unit (SICU) of the University Hospital Complex of Ourense. The protocol (number 2016/371) was submitted to and approved by the Pontevedra-Vigo-Ourense Research Ethics Board.

Patients admitted to the SICU between 1 July 2015 and 15 November 2015 with at least 1 simultaneous POC ABG and CLT result were included in the study, in other words, patients from whom samples had been collected and tested simultaneously and recorded in a validated central laboratory report. Patients under 18 years of age, and any patients not meeting the inclusion criterion were excluded.

The following variables were collected: age, sex, reason for admission to the SICU, APACHE II score, Hb according to ABG, haematocrit (Hct) according to ABG, Hb according to CLT, Hct according to CLT, lactate, sodium, potassium, ordinary biochemical sodium, standard electrolyte panel (sodium and potassium), platelets, and leukocytes. All data were anonymised at the time of collection. All irrelevant information was removed from our records at the end of the study.

The primary outcome measures were Hb according to POC ABG testing and Hb according to conventional CLT. For this purpose, the results of the ABG test and CLT performed simultaneously were obtained from the final validated laboratory report. Blood samples drawn from patients were tested using the Siemens Rapidlab 1265 (Siemens Healthcare GmbH, Henkestr. 127, 91052 Erlangen, Germany) blood gas analyser and the WBC was performed using the Sysmex XN-1000 (Sysmex Corporation, 1-5-1 Wakinohama-kaigandori, Chuo-ku, Kobe, Hyogo 651-0073, Japan) haematology analyser.

Given that the aim of the study was to detect errors in respect of the total sample analysed, we decided to calculate the sample size on a proportional basis. Therefore, for a 95% confidence interval and a margin of error of 3%, 1,067 samples were necessary. Estimating 5% of losses in the pre-analytical or analytical phase, the final number of samples needed for analysis was 1,123, which was our sample size. Statistical analysis was performed on SPSS 16 for Windows, MedCal 17.9 for Windows, LibreOffice 5.1 for Linux, Sofa Statistics 1.4.6 for Linux, and EpiDat 4.2.

The Hb thresholds for transfusion were <7, <8, <9 and <10 g/dl. These are the values established in the Seville Consensus Document,[5] endorsed by the Spanish Society of Intensive and Critical Care Medicine and Coronary Units (SEMICYUC), the Spanish Society of Anaesthesiology, Critical Care and Pain Management(SEDAR), the Spanish Society of Haematology and Haemotherapy (SEHH), Blood Transfusion (SETS), Thrombosis and Haemostasis (SETH), and the Spanish Society of Hospital Pharmacy (SEFH). According to the GRADE[6] methodology, a strong recommendation implies in all cases that the benefits of the intervention clearly outweigh the risks and burdens (positive recommendation) or vice versa (negative recommendation). A 1 A recommendation is supported by high or moderate quality evidence and indicates that the intervention can apply to most patients in most circumstances without reservation.[7]

In critical, polytrauma and/or surgical patients, with no cardiological and/or central nervous system involvement, we recommend transfusion of PRBC to maintain Hb levels