Non Invasive methods of Hemoglobin testing

Dr. Ankit Mathur
Consultant Transfusion Medicine & Transplant Immunology

সুপ্রভাত
Donor selection

- First & the most important step in Blood Safety
- VNRBD
- Donor Questionnaire
- Medical History
- High Risk behavior
- Physical Examination
- Hemoglobin
Hemoglobin Testing

- 12.5 gm% or more
- WHO Color Strip test
- CuSO4 Technique
- HemoCue
- Hematology Analyzer/ cell counter (venous blood): Most accurate
- Non Invasive technique: Orscence NBM 200
Copper Sulphate Method

- Quick test is generally performed on a capillary sample
- Finger-prick method
- Widely used given its speed, simplicity, transportability, reproducibility and cheapness
- Basic Hb info of 12.5 gm%
- Unreliable due to variability in the droplet of capillary blood obtained
- False results
HemoCue Method

• Portable hemoglobinometer that uses the dry chemistry principle
• The HemoCue method can be used in the field to analyze blood collected in a microcuvette.
• The photometer is easy to transport because it is small and light; it is battery operated and gives consistent results.
Challenge with Finger Prick test

• The finger prick is reported by blood donors as one of the worst parts of the blood donation process
• Pain & Discomfort
• Eliminating a major source of discomfort for donors may improve donor satisfaction and increase their willingness to donate in the future
• NON INVASIVE HB ESTIMATION
Orsense Hb testing Tech: NBM 200

• OrSense’s patented SpectOLight™ technology, known as Occlusion Spectroscopy, uses a non-invasive optical measurement.

• The NBM 200 method involves a non-invasive device to measure the heartbeat and Hb concentration at the base of a finger or thumb.

• System has ring-shaped re-usable sensor/probe, placed for preference around the thumb, and a small portable monitor with a graphic display, containing a microprocessor that calculates result and shows it on the screen
Orscence Hb Estimation Tech: Principle

- The pressure applied by the sensor temporarily occludes the blood flow in the finger, creating new blood dynamics which generate a unique, strong optical signal, yielding a high signal-to-noise ratio which is wholly blood specific.

- Analysis of the signal provides the sensitivity necessary to measure hemoglobin, pulse-rate, oxymetry (even under severe low perfusion levels), and other analyte concentrations.
Orscence Hb Estimation Tech: Principle

• The probe is composed of eight diodes generating bands of light in the red (610 nm) and infrared (935 nm) fields, plus a photocell receiving the light after it has passed through the patient's skin and circulation.

• At those wavelengths Hb absorbs light.

• The photocell registers the light penetrating the thumb and converts the intensity of the light spectrum into an electronic signal which is sent to the device to be processed and the result displayed.
Orscence Hb Estimation Tech: NBM 200
Orscence Hb Estimation Tech: Benefits

• NON INVASIVE
• No pain & discomfort
• Quick
• No capillary sample
• Portable machine
• Suitable for mobile camps
Orscence Hb Estimation Tech: Limitations

• Variations in the results
• Risk of false acceptance OR deferral of donors
• Well documented validation of the process is required
• Quality Control/ Calibration
A non-invasive strategy for haemoglobin screening of blood donors

Pasquale Pompili Pagliaro, Anna Rita Belardinelli, Vincenzo Bello, Petar Salamon, Silvia Manfroi, Pier Luigi Tazzari

Immunohaematology and Transfusion Unit, S. Orsola-Malpighi Hospital, Bologna

Introduction. Assessing blood-donor haemoglobin (Hb) is a worldwide screening requirement against inappropriate donation. The pre-donation Hb (which should be at least 12.5 g/dL in women and 13.5 g/dL in men) is usually determined in capillary blood from a finger prick, using a spectrophotometer which reveals the absorbance of blood haemolysed in a microcuvette. New non-invasive methods of measuring Hb are now available.

Materials and methods. In the first semester of 3 consecutive years three different strategies were employed to screen donors for anaemia at the moment of donation. In 2011 all whole-blood donors underwent the finger-prick method using azide-methaemoglobin: the test’s negative predictive value (NPV) was determined by comparison with the sub-threshold Hb values ascertained by haemocytometry of test-tube blood drawn at the start of the donation. In 2012 the donor evaluation was based on NBM 200 occlusion spectrophotometry. The same approach was kept in 2013, but a haemocytometry test was added on a pre-donation venous sample drawn from donors who, though fit to donate, had previous critical Hb values in their clinical records.

Results. In 2011, the NPV (in 3,856 donors) was 96% for women and 95% for men; in 2012 (3,966 donors), the values were 85% and 95%, respectively, and in 2013 (3,995 donors) they were 91% and 97%, respectively. Fisher’s test for contingency tables revealed no statistically significant differences between 2011 and 2012, but the 2013 results were a significant improvement.

Discussion. Measuring Hb by finger prick is not wholly satisfactory since, above all in women, the result of this screening may subsequently be belied by the haemocytometry finding of an unacceptable Hb value. Using a non-invasive method does not diminish the selective efficiency. In women, in particular, adding a haemocytometric test on a venous sample significantly improves donor selection and avoids the risk of inappropriate donation or blood-letting.

Keywords: donor selection, pre-donation haemoglobin, non-invasive method.
Comparison of the Accuracy of Noninvasive Hemoglobin Sensor (NBM-200) and Portable Hemoglobinometer (HemoCue) with an Automated Hematology Analyzer (LH500) in Blood Donor Screening

Moon Jung Kim, M.D.¹, Quehn Park, M.D.², Myung Hee Kim, M.D.³, Jeong Won Shin, M.D.⁴, and Hyun Ok Kim, M.D.⁵

Department of Biomedical Laboratory Science¹, Eulji University College of Health Science, Seongnam; Research Institute of Medicine and Pharmacy², Chung-Ang University, Seoul; Quality Assurance Division³, Hanmaum Blood Center, Gwacheon; Department of Laboratory Medicine⁴, Soonchunhyang University College of Medicine, Seoul; Department of Laboratory Medicine⁵, Yonsei University College of Medicine, Seoul, Korea
Results: The mean Hb values of 506 blood donors were 14.1 g/dL by the NBM-200, 14.0 g/dL by the LH500, and 14.3 g/dL by the HemoCue. The correlation between the LH500 and the NBM-200 was substantial (ICC=0.69), while that between the LH500 and the HemoCue agreed almost perfectly (ICC=0.86).

Conclusions: The possibility to judge to be eligible for donors who are ineligible to donate was substantial when using NBM-200. Even though the NBM-200 has the apparent advantage of noninvasiveness, its use in pre-screening should be given meticulous attention. Since pre-donation testing is crucial to protecting donors’ health, complete evaluation of the instrument should be performed prior to use.
STUDY OF NEWER INVASIVE AND NON-INVASIVE METHODS OF HAEMOGLOBIN ESTIMATION IN BLOOD DONOR SCREENING - A STUDY ON 200 DONORS

Pankaj Malukani¹, M. D. Gajjar², R. N. Gonsai¹, Nidhi Bhatnagar², H. M. Goswami¹

¹Department of Pathology, B. J. Medical College, Ahmedabad, Gujarat, India
²Department of Immunohematology and Blood Transfusion, B. J. Medical College, Ahmedabad, Gujarat, India

E-mail of Corresponding Author: Pankaj.malukani@yahoo.co.in

ABSTRACT

Background: Despite the wide range of methods available for measurement of haemoglobin (Hb), no single technique has emerged as the most appropriate and ideal for a blood donation setup. To cater to this need both invasive and non-invasive techniques of haemoglobin estimation were analysed.

Aims and Objectives: To compare invasive and non-invasive methods of haemoglobin estimation in terms of accuracy, sensitivity and donor satisfaction.

Materials and Methods: A prospective study utilizing 200 blood samples was carried out in a blood donation setting for quality evaluation of five methods of haemoglobin estimation: Haematology cell analyser (reference), DiaSpect, CuSO₄, HemoCue and NBM-200.

Results: Mean value of HemoCue (mean ± SD = 13.8 ± 1.7 g/dl) was higher by 0.26 compared to reference (mean ± SD = 13.54 ± 1.52 g/dl). DiaSpect proved to be the best technique (sensitivity 99.4%, specificity 94.4% and likelihood ratio 17.75). CuSO₄ proved to be good with Negative Predictive Value close to 91.4%. NBM-200 shows wide variation but the mean of the difference being statistically not significant.

Conclusion: CuSO₄ method gives accurate results, if strict quality control is applied. HemoCue and DiaSpect are too expensive to be used as a primary screening method in an economically restricted country like India, but are accurate. NBM-200 is a non-invasive method and gives good result with better compliance and donor satisfaction.

Keywords: Blood donation, haematology cell analyser, DiaSpect, HemoCue, NBM-200, CuSO₄
Non Invasive Hb Testing: Anemia Screening
Noninvasive and Continuous Hemoglobin (SpHb®) Monitoring

• Technology from Masimo

• Real-time visibility to changes – or lack of changes – in hemoglobin between invasive blood sampling

• Surgical, post surgery, trauma

• Better Pt care
Noninvasive and Continuous Hemoglobin (SpHb®) Monitoring
Summary

• Hb Testing is critical part of Donor Selection Process
• Hb test method should be carefully selected
• Method should be validated & quality controlled
• Cost effective & useful for mobile camps
• Non Invasive tech are promising for donor comfort
• Careful Validation is required
Thank you
ধন্যবাদ
তোমাকে ধন্যবাদ