Noninvasive Assessment of Excessive Erythrocytosis as a Screening Method for Chronic Mountain Sickness at High Altitude.

High Alt Med Biol. 2015 Jun;16(2):162-8. doi: 10.1089/ham.2015.0026. Epub 2015 May 14. Vyas KJ(1), Danz D(2), Gilman RH(3), Wise RA(1), León-Velarde F(4), Miranda JJ(5,)(6), Checkley W(1).

Noninvasive assessment of excessive erythrocytosis as a screening method for chronic mountain sickness at high altitude. High Alt Med Biol 16:162-168, 2015.-Globally, over 140 million people are at risk of developing chronic mountain sickness, a common maladaptation to life at high altitude (>2500 meters above sea level). The diagnosis is contingent upon the identification of excessive erythrocytosis (EE). Current best practices to identify EE require a venous blood draw, which is cumbersome for large-scale surveillance. We evaluated two point-of-care biomarkers to screen for EE: noninvasive spot-check tests of total hemoglobin and oxyhemoglobin saturation (Pronto-7, Masimo Corporation). We conducted paired evaluations of total serum hemoglobin from a venous blood draw and noninvasive, spot-check testing of total hemoglobin and oxyhemoglobin saturation with the Pronto-7 in 382 adults aged ≥35 years living in Puno, Peru (3825 meters above sea level). We used the Bland-Altman method to measure agreement between the noninvasive hemoglobin assessment and the gold standard lab hemoglobin analyzer. Mean age was 58.8 years and 47% were male. The Pronto-7 test was unsuccessful in 21 (5%) participants. Limits of agreement between total hemoglobin measured via venous blood draw and the noninvasive, spot-check test ranged from -2.8 g/dL (95% CI -3.0 to -2.5) to 2.5 g/dL (95% CI 2.2 to 2.7), with a bias of -0.2 g/dL (95% CI -0.3 to -0.02) for the difference between total hemoglobin and noninvasive hemoglobin concentrations. Overall, the noninvasive spot-check test of total hemoglobin had a better area under the receiver operating characteristic curve compared to oxyhemoglobin saturation for the identification of EE as measured by a gold standard laboratory hemoglobin analyzer (0.96 vs. 0.82; $p<0.001$). Best cut-off values to screen for EE with the Pronto 7 were ≥19.9 g/dL in males and ≥17.5 g/dL in females. At these cut-points, sensitivity and specificity were both 92% and 89% for males and females, respectively. A noninvasive, spot-check test of total hemoglobin had low bias and high discrimination for the detection of EE in high altitude Peru, and may be a useful point-of-care tool for large-scale surveillance in high-altitude settings.