Perfusion Index Measurement in Predicting Hypovolemic Shock in Trauma Patients

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Background: Perfusion index (PI) derived from pulse oximeter shows the ratio of the pulsatile blood flow to the nonpulsatile blood flow or static blood in peripheral tissue.

Objectives: The aim of this study was to investigate the relationship between PI and blood transfusion necessity in 24 h and stage of hemorrhagic shock, as well as the utility of PI according to laboratory and clinical parameters, and determining the major risk of hemorrhage.

Methods: PI was measured with a pulse oximeter in 338 patients (235 males, average age 41.8 ± 17.94 years). Laboratory parameters (hemoglobin, hematocrit, lactate, base deficits, pH) and clinical parameters (pulse rate, respiratory rate, SpO2, systolic blood pressure [SBP] and diastolic blood pressure [DBP]), shock index (SI) and revised trauma score (RTS) were recorded. Univariate analysis was used to determine major risk for bleeding, and the receiver operating characteristic curves were performed to compare parameters.

Results: PI was < 1 in 39 (11.5%) patients. Positive correlation between PI and hemoglobin ($p < 0.001$; r: 0.320), hematocrit ($p < 0.001$; r: 0.294), base deficit ($p < 0.001$; r: 0.315), pH ($p < 0.05$; r: 0.235), SBP ($p < 0.001$; r: 0.146), DBP ($p < 0.001$; r: 0.259), SpO2 ($p < 0.001$; r: 0.197), RTS ($p < 0.001$; r: 0.344), and negative correlation with lactate ($p < 0.05$; r: -0.117), pulse ($p < 0.001$; r: -0.326), respiratory rate ($p < 0.001$; r: -0.231), and SI ($p < 0.001$; r: -0.257) were detected. A difference was detected between class 1 and 2, and class 1 and 3 (both $p < 0.05$) in hemorrhagic shock. Thirty-one with PI < 1 had blood transfusion within 24 h ($p < 0.001$; odds ratio 111.98, sensitivity 75.6%, specificity 97.3, positive predictive value 79.5%, negative predictive value 96.7%). The main risk factors of the need for blood transfusions were PI, pulse rate, and SpO2. PI was more significant than lactate, base deficit, RTS, and SI measurements.

Conclusion: PI might be beneficial in the detection and exclusion of critical patients and blood transfusion needs in the emergency department. PI can be used with vital signs and shock parameters in the early diagnosis of hemorrhage.