Heart Rate, But Not Heart Rate Variability or Pulse Oximetry Parameters of Perfusion, Predicts Hypotension during Spinal Anesthesia for a Cesarean Section: A Prospective Observational Study
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Background and Goal of Study
Spinal anesthesia for cesarean section induces hypotension which may exert severe adverse effects. Baseline peripheral vasomotor tone, volume status, and sympathetic activity are known to affect the degree of hypotension. Therefore, we hypothesized that the perfusion index (PI), pleth variability index (PVI), heart rate (HR), and parameters of heart rate variability (HRV) may predict hypotension. The goal of our study was to determine whether hypotension after spinal anesthesia could be predicted by such measures as PI, PVI, HR, ratio of low frequency (LF) and high frequency (HF) (LF/HF) of HRV, and entropy of HRV.

Methods
PI, PVI, HR, LF/HF, and entropy were measured in women after 37 weeks of pregnancy undergoing elective cesarean section. These parameters were measured before induction of spinal anesthesia for 5 min. Epidural catheter was placed at the T12/L1 interspace, and spinal anesthesia was induced at the L3/4 or L4/5 interspace with 0.5% hyperbaric bupivacaine (10mg) and fentanyl (10mcg). Hypotension was defined as the systolic blood pressure below 80 mmHg, and was treated immediately with ephedrine 8mg. The predictive value of these parameters for detecting hypotension was assessed using logistic regression with Akaike's information criterion stepwise method. The predictive ability model was examined by generating the receiver operating characteristic (ROC) curve. And the gray zone approach was used to minimize the risks of misclassification by showing the range of values where a prediction of hypotension was inconclusive. The gray zone was determined as range between the points where sensitivity and specificity became 90% each (diagnostic tolerance of 10%).

Results
We enrolled 81 patients. Hypotension occurred in 51 of 81 patients (63%). Baseline HR was significantly higher in patients who developed hypotension (P=0.006). The logistic regression revealed only HR as an independent factor to predict hypotension (odds ratio, 1.06; 95% confidence interval [CI], 1.01-1.13; P= 0.032). Area under the ROC curve of HR was 0.686 (95%CI, 0.558-0.803). A gray zone of HR was shown within 71 to 89, and the numbers of parturients in the gray zone were 49 (60.5%).

Conclusion
Our results showed that the PI, PVI, and HRV did not predict hypotension, while preanesthetic HR of less than 71 bpm and more than 89 bpm was a prognostic factor for hypotension after spinal anesthesia in healthy women undergoing a cesarean section.