

## **Effect of Noninvasive Hemoglobin Monitoring on Postoperative Anemia and Inappropriate Blood Transfusion in Patients Undergoing Total Hip Arthroplasty and Total Knee Arthroplasty: A Randomized Controlled Study**

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**Objective:** Anemia and blood transfusion are related to mortality and morbidity in surgical patients. In this study, we investigated whether SpHb measuring was useful to avoid postoperative anemia and blood transfusion after total hip arthroplasty (THA) and total knee arthroplasty (TKA).

**Method:** Institutional Review Board (IRB No.15-8-05) was obtained and this study was registered with UMIN (ID 000019341) and conducted a randomized parallel group comparison test. Patients who underwent THA or TKA surgery were randomly assigned to receive blood transfusion either SpHb-guided or routine care (control). The SpHb group had blood transfusion adjusted to maintain a SpHb value more than 8 g/dL during postoperative periods. Routine care (control) group had SpHb measured but not revealed to attending physician. Blood transfusion was adjusted according to traditional clinical signs, blood loss and hemodynamic parameters. Hemoglobin (Hb) was measured using a laboratory hematology analyzer on the first postoperative day and target of Hb value in both groups was set to 8 g/dL or more. We compared the laboratory measured Hb at POD 1 and the ratio of the patients with SpHb less than 8 g/dL, and amounts of blood transfusion. Inappropriate blood transfusion was defined as excessive blood transfusion in the case of Hb >12 g/dL or delayed blood transfusion in the case of Hb <8 g/dL. Data analysis: Statistical analysis was expressed as a mean  $\pm$  standard deviation (SD) for normally distributed variables and used t-test, Chi-squared test and Fisher's test.

**Results:** This study enrolled 150 adult patients. After excluding, the SpHb group was 73 patients (THA36, TKA37) and the control group was 72 patients (THA36, TKA36). Hb on POD 1 was not significantly different between control and SpHb group (10.7 $\pm$ 1.3 g/dL and 10.8 $\pm$ 1.2 g/dL respectively), and there was 1 patient whose Hb developed less than 8 g/dL in the control group. In the control group, 5 (7.1%) patients developed SpHb < 8 g/dL during postoperative period, but there was no patients of SpHb < 8 g/dL in the SpHb group (P=0.028).

There was no significant difference in blood transfusion between both groups (413  $\pm$  121 mL in the control group vs. 368  $\pm$  109 mL of autologous blood transfusions in the SpHb group, and 354  $\pm$  127 mL vs. 382  $\pm$  138 mL of allogeneic blood transfusions, respectively). Among patients transfused with allogeneic blood, 7 patients in the control group received inappropriate blood transfusion which was defined as excessive blood transfusion in the case of SpHb >12 g/dL (n=5) or delayed blood transfusion in the case of SpHb <8 g/dL (n=2). However, there was no patient to receive inappropriate blood transfusion in the SpHb group (P=0.002).

**Conclusion:** Postoperative monitoring of SpHb cannot reduce the blood transfusion nor effect on Hb at POD 1, but it can prevent accidental and transient anemia, and excessive or delayed blood transfusion in patients undergoing THA and TKA.