Introduction: The cost-effectiveness of preoperative autologous blood donation (PABD) can be improved substantially by the avoidance of overcollection and overtransfusion of autologous blood [1]. We retrospectively collected the hemoglobin values of the patients who had operated primary total hip arthroplasty and had received autologous blood transfusion. The hemoglobin values were calculated according to supposititious bloodletting. The results were applied to published indication of allogeneic blood transfusion and simulation was done to minimize the rate of allogeneic blood transfusion.

Materials and Methods: The hemoglobin values of 180 patients who had operated primary hip arthroplasty and had received 800 ml autologous transfusion were used as basis. The patients who received allologous blood transfusion were not included. When the hemoglobin value prior to PABD was ≤ 14, the patient received 24,000 unit of epoetin alfa. All patients were managed with unilateral primary total hip arthroplasty by one surgeon (KH). Against intraoperative and postoperative bleeding, blood was salvaged and reinfused. The bottom of the hemoglobin value in hospital was picked up and calculated according to the hypothesis that 400 ml autologous transfusion was converted to 400 ml of bloodletting and no transfusion was converted to 800 ml of bloodletting. Estimated change of hemoglobin value (ECHV) was calculated using the following formula [2]: ECHV = (Hb value prior to PABD × supposititious bloodletting volume) / patient’s blood volume (PBV). PBV was calculated using patient’s height and weight according to the following formula [3]: PBV = k1 × height (m)3 + k2 × weight (kg) + k3, where k1 = 0.3669, k2 = 0.03219, k3 = 0.6041 for men; k1 = 0.3561, k2 = 0.03308, k3 = 0.1833 for women. Estimated bottom of hemoglobin value (EBHV) was calculated according to the following formula: EBHV = actual bottom of hemoglobin value (ABHV) – ECHV. In the simulation if 400 ml of bloodletting, hemoglobin value prior to second PABD was used to calculate ECHV. In the simulation of 800 ml of bloodletting, hemoglobin value prior to first and second PABD was used separately to calculate ECHV. Simple regression analyses were performed, with ABHV and EBHV as dependent variables and hemoglobin values prior to first PABD as independent variables.

Results: There was a significant correlation between hemoglobin values prior to first PABD, and, ABHV and EBHV. Assuming (1) hemoglobin value prior to first PABD < 12 g/dl indicated 800 ml PABD (Table 1), (2) hemoglobin value prior to first PABD ≥ 12 g/dl and < 15 g/dl indicated 400 ml PABD (Table 2), (3) hemoglobin value prior to first PABD ≥ 15 indicated no PABD (Table 3), and (4) postoperative hemoglobin value < 7.0 g/dl indicated allologous red blood-cell transfusion [4], 4 of 180 patients (2.2 %) indicated allologous transfusion and 151 of 360 PABD (42 %) considered avoidable.

Discussion: PABD is a widely accepted practice as a result of concern over the risks of allologous blood transfusion, and it is the standard of care for major elective surgeries [5]. However, PABD is not risk free, furthermore, it is time consuming and may not be cost-effective [6]. In total hip arthroplasty, PABD provided no benefit for nonanemic patients and increased the likelihood of autologous transfusion, wastage of predonated units, and costs [4]. This study indicates that the blood management program according to the hemoglobin value prior to PABD is possible to reduce overcollection and overtransfusion of autologous blood. The current study has some limitations. We disregarded the erythropoiesis stimulated by bloodletting, time depending anemia recovery, and the effects of epoetin alpha. To overcome these limitations, randomized prospective study will be needed.