Should asymptomatic patients discharged with lower hemoglobin expect worse outcomes after valve surgery?

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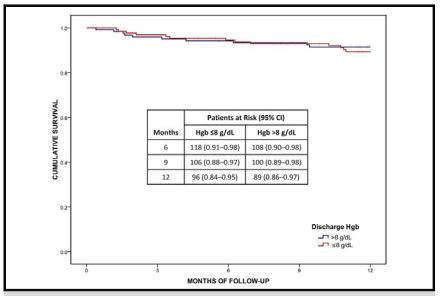
ABSTRACT

Objective: Blood transfusion in cardiac surgery patients is associated with increased morbidity and cost. The decision to transfuse patients after surgery varies but is often based on low hemoglobin (Hgb) levels, regardless of symptom status. This study examined whether asymptomatic patients discharged with lower Hgb levels had increased risk for perioperative complications and 1-year mortality.

Methods: Between 2008 and mid-2014, a total of 1107 valve-only procedures were performed. Patients discharged alive with complete data (N = 1044) were divided into 2 groups with discharge Hgb levels of ≤8 g/dL (n = 153) or >8 g/dL (n = 891). Propensity score matching was conducted between Hgb groups, resulting in 152 patient pairs.

Results: In multivariate analyses, discharge Hgb level did not predict 30-day mortality (odds ratio [OR] = 1.01, P = .991), 1-year survival (hazard ratio [HR] = 0.87, P = .34), or readmission <30 days (OR = 0.92, P = .31). Furthermore, after propensity score matching, no differences were found between groups with Hgb levels ≤8 versus >8 g/dL in 30-day mortality (0% vs 0.7%, P > .99) or readmissions (14% vs 16%, P = .52). Cumulative 1-year survival was similar between matched groups with discharge Hgb level of ≤8 versus >8 g/dL (89.3% vs 91.4%, P = .67). Matched groups with Hgb level ≤8 versus >8 g/dL had similar physical (28% vs 18% increase; P = .27) and mental (7% vs 6% increase; P = .94) health-related quality of life (HRQL) improvements at 6 months.

Conclusions: Asymptomatic patients discharged with lower Hgb levels did not manifest inferior outcomes, including perioperative morbidity/mortality, readmission <30 days, HRQL, and 1-year survival. The practice of blood transfusion to correct lower Hgb levels in asymptomatic patients should be eliminated, as it may be associated with increased morbidity without apparent clinical benefits after valve surgery. (J Thorac Cardiovasc Surg 2015;150:1322-9)



Cumulative survival for propensity score–matched groups, by discharge Hgb level.

Central Message

In asymptomatic valve surgery patients, hemoglobin level at discharge was not predictive of early outcomes or 1-year survival.

Perspective

This study found no association between adverse outcomes and a lower Hgb level at discharge in asymptomatic patients after valve surgery. The practice of blood transfusion after valve surgery to correct lower Hgb levels in asymptomatic patients before discharge should be eliminated, as it may be associated with increased morbidity without apparent clinical benefits.

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The great majority of transfusions of blood and blood products in the United States are given to cardiac surgery patients.[1] For many decades, common practice has been to transfuse surgery patients when hemoglobin (Hgb) levels fall to <10 g/dL, regardless of whether the patient is symptomatic.[2] This practice is based on evidence that shows an association between anemia and increased morbidity and mortality.[3,4] Yet with some exceptions,[5] the preponderance of literature shows transfusion itself to be associated with an increased risk of morbidity and mortality, a longer length of stay, and increased costs.[6-9]

Several associations and organizations have set forth guidelines for perioperative blood transfusion.[1,10-12] Despite these guidelines, however, actual transfusion practices vary widely both within and among institutions.[13-16] Moreover, although the most recent blood conservation guidelines from the Society of Thoracic Surgeons (STS) and the Society of Cardiovascular Anesthesiologists are based on an extensive survey of the published literature, those

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Abbreviations and Acronyms
Hgb = hemoglobin
HR = hazard ratio
HRQL = health-related quality of life
OR = odds ratio
SF-12 = Medical Outcomes Study Short-Form 12
STS = Society of Thoracic Surgeons

organizations found almost no evidence to stratify blood conservation interventions.[1]

To date, there is no established, widely recognized no Hgb threshold below which blood transfusion can be consistently recommended for patients undergoing cardiac surgery.[2] This threshold is especially important for patients who have lower Hgb levels well after the intensive phase of their postoperative care, when they are asymptomatic, ambulating very well, and awaiting discharge from the hospital. The purpose of this study was to determine whether lower Hgb levels at discharge in asymptomatic patients who have undergone valve surgery are associated with an increased risk of perioperative complications and 1-year mortality.

METHODS

All study procedures were performed in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. This prospective study was conducted at a single center with a cohort of consecutive patients who underwent valve-only cardiac surgical procedures between April 2008 and June 2014 and were discharged alive from the hospital. During that period, 2551 patients underwent valve surgery, and 1107 valve-only procedures were performed (Figure 1).

All patients included in these analyses (N = 1044) had complete data available on presurgery and discharge Hgb and on blood transfusion. Blood transfusion was managed in accordance with our rigorous institutional protocol and the STS guidelines.[1,17] Patients were divided into 2 groups based on discharge Hgb levels: ≤8 g/dL (n = 153) and >8 g/dL (n = 891). Within the former group, 24 (16%) patients had a discharge Hgb level of ≤7 g/dL.

The value of 8 g/dL was selected for the Hgb cut-point to represent patients with significant anemia, because it additionally represents a strong relationship with blood product transfusion, even in asymptomatic patients.[18] Asymptomatic patients were defined as clinically stable, ambulating well on the floor, and maintaining normal blood pressure with no orthostatic hypotension, dizziness, tachycardia, tachypnea, or shortness of breath. These factors were evaluated daily as part of our institutional clinical protocol.

Data were collected prospectively using our local STS database and institutional cardiac surgery database. Outcome measures included STS-defined morbidity, readmissions within 30 days, postdischarge mortality within 30 days of surgery, mortality during the first year of follow-up, and health-related quality of life (HRQL) using the Medical Outcomes Study Short Form-12 (SF-12) before surgery and at the 6-month follow-up after surgery. This study was approved by our local institutional review board (IRB nos. 06.022 and 12.055). Patient consent was waived for our registry.

Statistical Analysis

All analyses were performed with SPSS Version 17.0 (SPSS Inc, Chicago, Ill) or R 2.10.1 (R Foundation for Statistical Computing, Vienna, Austria), and a 2-sided P value < .05 was used to determine significance. Continuous data are presented as mean ± SD, or median (interquartile range); categorical data are presented as frequency (percentage), unless otherwise noted. Comparisons of the discharge Hgb groups were conducted using independent-samples t tests or the Mann-Whitney U test for continuous variables, and χ^2 analysis or the Fisher exact test for categorical variables.

Outcome analyses were first conducted in the unmatched full sample to evaluate the relationship of discharge Hgb level as a continuous variable to the primary outcomes, including 30-day postdischarge mortality and 1-year survival, as well as discharge location and readmission within 30 days after discharge. These analyses were conducted using multivariate logistic and Cox regressions with the following covariates: age, gender, body mass index, chronic pulmonary disease, diabetes, ejection fraction, cerebrovascular disease, preoperative Hgb level, year of surgery, cardiopulmonary bypass time, and receipt of blood products during surgical hospitalization. Box-Tidwell testing revealed that the interaction term of discharge Hgb with the natural log of discharge Hgb level was not significant in any of the logistic regression analyses.

As a second step, propensity score matching was conducted to improve clinical covariate balance between the discharge Hgb groups, using the MatchIt package within R.[19-21] Propensity scores were estimated via a logistic model that examined discharge Hgb group as the dependent variable and the following independent variables selected a priori: age, gender, chronic pulmonary disease, diabetes, ejection fraction, cerebrovascular disease, preoperative Hgb level, year of surgery, cardiopulmonary bypass time (minutes), and blood product transfusion during the surgical hospitalization.

Patients with a discharge Hgb level of ≤8 g/dL were matched to patients with a discharge Hgb level of >8 g/dL, using propensity scores and a caliper of 0.25 propensity score SD.[19] After matching, balance was improved for all covariates in the logistic model (Table 1), and almost all patients with a discharge Hgb level of ≤8 g/dL were able to be matched (Figure 2). A total of 152 pairs of patients remained after propensity score matching (N = 304), and this sample was used in analyses where noted.

Outcome analyses on the propensity score–matched sample (N = 304) utilized independent-samples t tests or Mann-Whitney U tests for continuous variables, and χ^2 analysis or the Fisher exact test for categorical variables. Kaplan-Meier survival analysis was used to compare the discharge Hgb groups on 1-year survival. Changes in HRQL between Hgb groups were examined using repeated measures ANOVA.

RESULTS

Patients

The mean age of patients in this sample (N = 1044) was 62.1 ± 14.0 years, and 37% were women. The sample collectively underwent 918 single-valve, 114 double-valve, and 12 triple-valve surgeries. The breakdown of which valve types were involved in these operations is: 514 mitral, 593 aortic, 72 tricuspid, and 3 pulmonary. Given that some patients had surgeries on multiple valves simultaneously, these numbers are not mutually exclusive. The mean Hgb level at discharge was 9.9 ± 1.7 g/dL; the distribution of discharge Hgb level is shown in Figure 3. Before matching, patients with a discharge Hgb level of ≤8 g/dL differed from patients with a discharge Hgb level of >8 g/dL in preoperative and intraoperative characteristics (Table 2).

In particular, patients with discharge Hgb level of ≤8 g/dL were more likely to be women (44% vs 36%, $P = .041$) and to have cerebrovascular disease (23% vs 11%,

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