Higher Hemoglobin Targets And Increased Adverse Outcomes In Pediatric Cardiac Surgery Patients

Branden M Engorn MD1, William W Yang BS1, Mereze Visagie1, Joshua A Wetzler1, Luca A Vricella MD2, Steve M Frank MD1, Dheeraj K Goswami MD1

1Department of Anesthesiology and Critical Care Medicine, Johns Hopkins School of Medicine, Baltimore, MD

2Department of Surgery, Johns Hopkins School of Medicine, Baltimore, MD

INTRODUCTION

In adult and pediatric cardiac surgery patients, the safety of a restrictive transfusion strategy has been demonstrated (1-4), but the ideal transfusion threshold in cyanotic children is unclear. However, the effects of a higher hemoglobin (Hb) target has not been studied. The primary hypothesis tested in this study was that higher Hb targets are associated with adverse outcomes in pediatric cardiac surgery patients, and the Hb threshold for this effect is higher in patients with cyanotic disease.

METHODS

After IRB approval, we reviewed 319 pediatric cardiac surgery cases at Johns Hopkins Hospital from March 2013-June 2015 (Table 1). We merged three databases from our institution including: our Pediatric Cardiac Surgery STS Database, Blood Management Database, and Impact Online Database. The primary outcome (hospital-acquired infection) was determined using ICD-9 and ICD-10 codes. Secondary outcomes included mortality and length of stay (LOS). By a retrospective chart review, we classified each patient as cyanotic vs. acyanotic and obtained the initial post-operative Hb upon admission to the PICU which was used as the target Hb. Our statistical analysis included Wilcoxon Rank to compare medians for LOS and Chi-square to compare percentages for infection rates.

RESULTS

The infection rate was increased in the acyanotic group with a target Hb level above 13 g/dL (P<0.05), and there was a trend towards an increased infection rate in the cyanotic group with a target Hb level above 15 g/dL (P=0.10) (Figure 1A). Patients were more than 4-times more likely to have an infection in the highest Hb groups. LOS was increased in the highest target Hb in both the acyanotic and cyanotic groups (P<0.05) (Figure 1B). There was no significant difference in mortality rate among the groups. There was no evidence of confounding as the STAT scores 1-2 and 3-5 were similar across the Hb target groups (Table 1). There was a difference in age and transfusion target with a higher proportion of neonates in the acyanotic group with higher Hb targets (Table 1A). There was a trend towards increased blood utilization in the higher Hb target groups but this was not statistically significant.

DISCUSSION

The results support our hypothesis that transfusing to a higher Hb target is associated with adverse outcomes. LOS was longer and statistically significant in both the acyanotic and cyanotic groups transfused to a higher Hb target. Infection rates were also increased in acyanotic patients transfused to a higher target. Although the Hb threshold is higher with cyanotic disease and shows a trend towards increased infection, this finding was not statistically significant. Our study is the first to show that transfusing to a higher Hb target is associated with increased morbidity. A potential mechanism for increased infection rates is non-transferrin bound iron in transfused blood which can promote infection (5). Larger prospective studies are needed to determine the safe upper limit for Hb targets in patients with and without cyanotic heart disease.

REFERENCES


