

ASSOCIATION OF BLOOD SAMPLING WITH ANEMIA IN THE PEDIATRIC INTENSIVE CARE UNIT OF ALEXANDRIA UNIVERSITY CHILDREN’S HOSPITAL

Magdy Abdel Fattah Ramadan, Manal Abd El Malek Antonios, Ali Yusuf Ali Chiragdin

Department of Pediatrics, Faculty of Medicine, Alexandria University

Introduction

Anemia is frequently observed in children who are critically ill, roughly 33% of those admitted to the Pediatric Intensive Care Unit (PICU) have anemia at the time of admission. In addition, another 41% of children are likely to develop anemia during their stay in the PICU. Overall, anemia affects around 75% of patients at some time during their critical illness. Anemia represents a prevalent complication among pediatric critical care patients. Blood loss, inflammation, hemolysis, and adherence to a restrictive transfusion strategy are various factors contributing to the onset. Notably, blood draws contribute to over 73% of the average daily blood loss of 5 mL in critically ill patients. Implementing blood conservation techniques to reduce the number of blood draws and the amount of blood taken and discarded are essential elements of a PBM program, to reduce the dangers of anemia and needless blood transfusions while simultaneously improving patient outcomes

Aim of the work

This study investigated the relationship between blood sampling and anemia incidence in the PICU, addressing prevalence, severity, blood loss reduction strategies, and complications from anemia and transfusions.

Patients and Methods

Over five years, 1262 patients were admitted to Alexandria University PICU, with 967 excluded based on criteria, and 295 enrolled in the study. Hemoglobin levels were monitored from admission until discharge, death, or receipt of blood products, with data collected from 2018 to December 2022, excluding bleeders. Out of the total studied children (n=295), 6.78% were deceased, 63.73% were discharged, and 29.49% had blood transfusion. In the group without Anemia at the end of follow-up (n=136): 5.88% were deceased, 88.97% were discharged, and 5.15% had blood transfusion. While in the group with Anemia at the end of follow-up (n=159): 7.55% were deceased, 67/159 (42.14%) were discharged, and 50.31% had blood transfusion. Figure (1) showed a decrease in hemoglobin over the days of PICU admission. It showed more decline of hemoglobin among deceased group compared to the decline noted among the discharged group of patients.

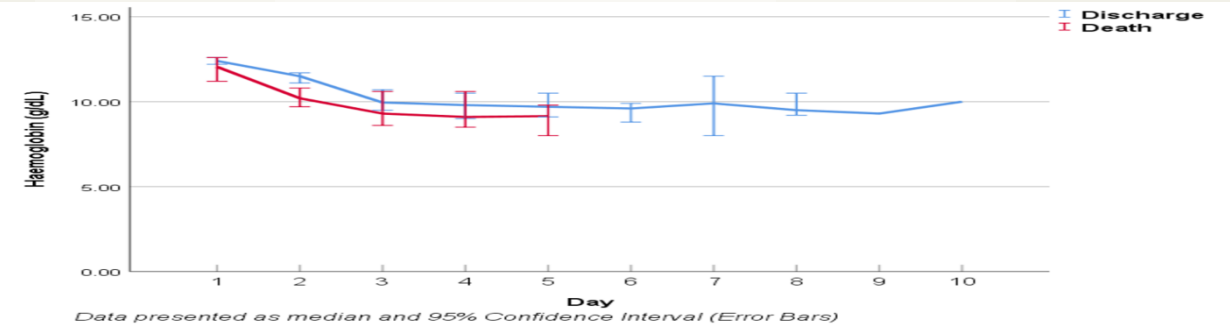


Figure (1): Hemoglobin level (g/dL) by the outcome.

Results

The initial hemoglobin (g/dL) was statistically significant higher [median (IQR):13.15 (12.10-14.05)] in the group without anemia at the end of follow-up compared with the group with anemia at the end of follow-up [median (IQR):11.70 (10.80-12.70)] (p<.001). Moreover, the final hemoglobin (g/dL) was statistically significantly higher [median (IQR):11.95 (11.20-12.85)] in the group without anemia at the end of follow-up compared with the group with anemia [median (IQR):8.70 (8.10-19.70)] at the end of follow-up (p<.001). The hemoglobin percentage decline (%) (Final vs. Initial) was statistically significantly lower in the group without (7.32%) anemia at the end of follow-up compared with the group with anemia (24.03%) at the end of follow-up (p<.001). The total number of blood draws (during PICU stay) was statistically significantly higher in the group with anemia at the end of follow-up compared with the group without anemia at the end of follow-up (p<.001). Multivariate logistic regression, revealed that increase in PELOD-2, increases in the total number of blood draws (during PICU stay), and the blood volume withdrawn per body weight (ml/kg), were independent risk factors to develop anemia.

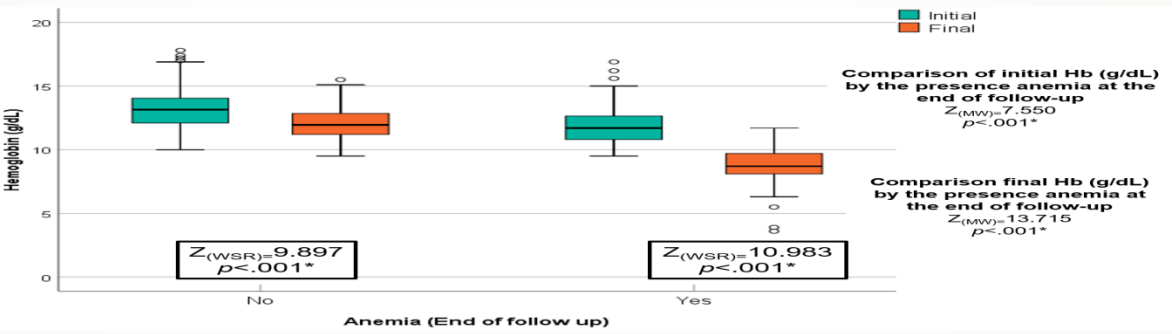


Figure (2): Box and whisker graph of (a) hemoglobin (g/dL) by anemia at end of follow-up, the thick line in the middle of the box represents the median, the box represents the inter-quartile range (from 25th to 75th percentiles), the whiskers represents the minimum and maximum after excluding outliers (circles) and extremes (asterisks).

Table (1): Univariate and Multivariate Logistic Regression for Anemia

	Univariate OR (LL – UL 95% CI)	p-value	Multivariate OR (LL – UL 95% CI)	p-value
Age (months)	0.983 0.978-0.988	p<.001*	0.996 .987-1.005	p=.359
Weight (Z score)	0.839 0.748-0.942	p=.003*	1.050 0.875-1.260	p=.599
PELOD-2	1.267 1.155-1.391	p<.001*	1.156 1.048-1.275	p=.004*
DKA	0.184 0.109-0.313	p<.001*	0.907 0.419-1.965	p=.804
Pneumonia	2.692 1.434-5.053	p=.002*	0.764 0.339-1.724	p=.518
Total Number of Blood Draws	1.420 1.246-1.618	p<.001*	1.232 1.083-1.403	p=.002*
Blood volume withdrawn per body weight (ml/kg)	1.528 1.352-1.727	p<.001*	1.318 1.063-1.635	p=.012*

Table (2): Univariate and Multivariate Logistic Regression for Mortality

	Univariate OR (LL – UL 95% CI)	p-value	Multivariate OR (LL – UL 95% CI)	p-value
Age (months)	0.982 0.973-0.991	p<.001*	0.998 0.984-1.012	p=.767
Weight (Z score)	0.794 0.692-0.910	p=.001*	0.763 0.644-0.978	p=.030*
PIM3	1.028 1.017-1.039	p<.001*	1.006 0.990-1.021	p=.479
PELOD-2	1.374 1.255-1.506	p<.001*	1.268 1.138-1.412	p<.001*
Mechanical Ventilation	25.716 8.917-74.163	p<.001*	11.907 3.591-39.475	p<.001*
Anemia	3.957 1.888-8.293	p<.001*	0.782 0.278-2.200	p=.642
Blood volume withdrawn per body weight (ml/kg)	1.191 1.092-1.299	p<.001*	01.013 0.830-1.237	p=.896

Conclusion

This research underscores the significant impact of blood loss, anemia, and transfusions in critically ill PICU children, emphasizing the need for clear guidelines. It found that 53.90% of non-anemic patients developed anemia by discharge, with pneumonia, blood sampling, and high PELOD-2 scores contributing to this. Mechanical ventilation and low weight (Z-score) were linked to increased mortality.