

A Quantitative Approach to differentiate hemolysis from dilutional changes in patients with Malaria

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INTRODUCTION

- Many factors contribute to development of anemia in hospitalized patients - impact of underlying disease process, phlebotomy in patients with prolonged hospital stay and effect of IV fluid administration.¹
- Iatrogenic hemodilution due to IV fluids can have a negative impact on patient's outcomes.
- Dilutional changes may wrongly prompt clinicians to recommend blood transfusion.²
- This scenario poses a particular challenge in patients hospitalized with severe malaria. In these patients, hemolysis occurs due to underlying pathophysiology of malaria. However, as they are also receiving IV fluids, iatrogenic hemodilution can occur simultaneously.³

AIM

To apply a recently proposed quantitative approach developed by Hale et. al³ to differentiate between hemolysis and hemodilution in patients hospitalized with severe malaria.

METHOD

- Retrospective study conducted at Shifa International Hospital, Pakistan (2016 – 2019).
- Hospital records of adult patients admitted due to severe malaria who received IV fluids were assessed. (Exclusion: children, pregnancy, diuretic use, dialysis dependence).
- Four step method proposed by Hale et. al³ was used to calculate the expected hemoglobin after IV fluid infusion. If expected hemoglobin is not concordant with actual hemoglobin, this is considered a consequence of hemolysis.

Steps for Quantitative Assessment of Dilutional changes:

Step 1: Calculate initial total blood volume
65 mL/kg of total body weight in women, 75 mL/kg in men

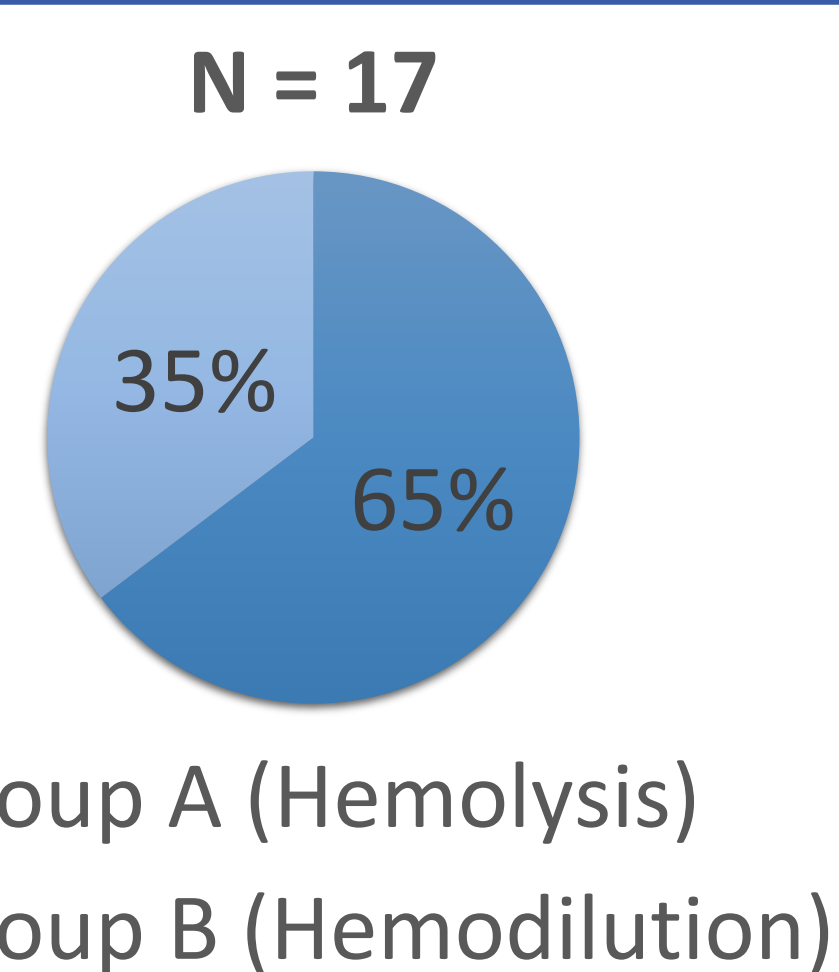
Step 2: Calculate total body hemoglobin
Hemoglobin concentration in g/dL multiplied by the total blood volume in dL

Step 3: Calculate expected post IV fluid total blood volume
For every 1 L of normal saline, approximately one-fourth will stay in the intravascular space. New total intravascular volume = initial blood volume + intravascular volume from the infusion.

Step 4: Calculate expected post-infusion hemoglobin concentration
Expected post-infusion hemoglobin concentration = total body hemoglobin divided by total blood volume

RESULTS

- **72** adult patients who met our inclusion criteria were admitted due to severe malaria.
- Mean age = 47 ± 16 years.
- 11 (64.7%) were male.
- **17 (23.6%)** patients developed a significant decrease in hemoglobin while receiving IV fluids.



- The mean drop in hemoglobin was **2.02 ± 0.66 g/dl** over a period 24 hours.

- Based on the quantitative method it was identified that 11 (65%) patients were in a state of hemolysis (Group A) whereas hemodilution had occurred in 6 (35%) patients (Group B).

	Group A (hemolysis) N = 11	Group B (hemodilution) N = 06	P value
Pre - IV fluids hemoglobin (Mean ± SD in g/dl)	12.66 ± 2.59	13.05 ± 0.79	0.730
Post - IV fluids hemoglobin (Mean ± SD in g/dl)	10.45 ± 2.45	11.55 ± 0.96	0.280
Volume of IV fluids received in last 24 hours (Mean ± SD in mL)	1205 ± 542	1443 ± 450	0.374
Difference in pre and post IV fluid hemoglobin (Mean ± SD in g/dl)	2.3 ± 0.62	1.5 ± 0.33	0.010
Difference between actual and expected hemoglobin post IV fluids (Mean ± SD in g/dl)	1.5 ± 0.56	0.49 ± 0.28	0.001

- The mean drop in hemoglobin was significantly higher in Group A as compared to Group B (2.31 ± 0.62 g/dl vs 1.5 ± 0.33g/dl, p=0.01).
- There was no significant difference in the volume of IV fluids administered to Group A and Group B (1.2 ± 0.5L vs 1.44 ± 0.49L, p=0.349).
- Two of the patients identified to be in hemolysis using the quantitative method received packed red cell transfusion.

CONCLUSIONS

- A quantitative approach can be used to reliably differentiate between hemolysis and dilutional changes in patients with severe malaria.
- This approach can aid clinicians in making informed decisions regarding patient management, and potentially prevent any unnecessary blood transfusions along with their adverse effects.

ACKNOWLEDGEMENT

Staff and Faculty from the Department of Pathology and Laboratory Medicine, Shifa International Hospital, Islamabad

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