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Letter to the Editor

Phlebotomy loss in sick newborns admitted in neonatal intensive care unit

Sir,

Improved neonatal care has resulted in increased survival of neonates and duration of hospital stay. These sick neonates are subjected to frequent diagnostic blood sampling. Phlebotomy loss (PL) is acknowledged as one of the primary factors leading to anaemia in critically ill infants.[1]

We conducted an observational, prospective study in our neonatal intensive care unit (NICU), which is an extra-mural unit after obtaining Institutional ethics committee approval. We aimed to estimate the blood volume lost due to phlebotomy in neonates admitted in NICU and determine the factors associated with it. Neonates admitted within 24 hours of birth were included in the study. Amount of blood withdrawn was recorded each day for all neonates till 14 days of admission or discharge whichever was earlier. We use micro sampling techniques; judicious ordering of blood investigations and minimizing overdraw of blood to reduce PL in our unit. Neonates managed as per standard treatment guidelines.

The male: female ratio of the enrolled babies was 1.4:1. Median [inter-quartile range (IQR)] of the total PL was 7 (5-11) ml. The median (IQR) of the PL/kg was 3.1 (2.1,5). The median (IQR) of the PL in extremely low birth weight (ELBW, n=2), very low birth weight (VLBW, n=17), low birth weight (LBW, n=27) and not LBW (NLBW, n=27) babies was 15.5 (1.30), 11 (6,14), 7 (5,10) and 6 (5,9) ml respectively (p=0.15). There was no difference in PL between the babies who died or survived (p=0.16). On univariate analysis, the PL had a significant positive correlation with the birth weight, gestational age and duration of hospital stay and a significant negative correlation with haemoglobin at discharge. On multivariate analysis, only the duration of hospital stay was significantly associated with PL (Table 1).

When PL/kg considered, gestational age, duration of hospital stays and Hb at discharge all significantly correlated even on multivariate analysis (Table 2).

Table 1: Linear correlation of phlebotomy blood loss with other factors.

Factors	*Correlation coefficient	P value	Adjusted correlation coefficient	P value
Birth weight (gm)	-0.002	0.005	-	-
Gestation age (weeks)	-0.635	<0.001	-0.265	0.06
Duration of stay	0.402	<0.001	0.39	<0.001
Haemoglobin at discharge	-0.875	<0.001	-0.23	0.09

*Pearson's correlation coefficient.

Table 2: Linear correlation of PL per kg loss with other factors.

Parameters	*Correlation coefficient	P value	Adjusted correlation coefficient	P value
Birth weight (gm)	-0.003	<0.001		
Gestation age (weeks)	-0.66	<0.001	-0.43	<0.001
Duration of stay	0.27	<0.001	-0.25	0.004
Haemoglobin at discharge	-0.71	<0.001	0.11	<0.001

*Pearson correlation coefficient. Only one baby needed packed red blood cell transfusion.

Some previous studies have focused on the PL in sick neonates. Most studies have studied PL in preterm and VLBW babies. Apart from preterm and VLBW babies our study population also included sick neonates who were term and LBW or NLBW. Agarwal et al did a retrospective analysis of neonates admitted in their neonatal intensive care unit and found the mean blood loss to be 9.38±8.8 ml per newborn with a range from 1-51 ml.[2] They found an inverse relationship of PL with gestation age and birth weight. They also concluded that blood overdraw per test was much higher than required by the laboratory. Aboalquez et al did a study to quantify PL in 132 VLBW babies, the median (IQR) blood loss as 16.5 (12.3-21.1) ml.[3] This was much higher than the PL of VLBW babies in our study. Sampling volume was different for transfused and non-transfused neonates with median volume of 14 (12.1-16.2) ml for non-transfused and 21.6 (17.5-29.4) ml for transfused infants.

Hellstorm et al studied 149 extremely preterm babies and found 58% depletion of endogenous blood volume during postnatal days 1-14 due to phlebotomy.[4] The median PL

was 40.4 ml/kg and inter quartile range of 23.9 to 53.3 ml/kg and correlated with erythrocyte transfusion volume ($r=0.870$, $p<0.01$). Sampling-related blood loss on postnatal days 1-7, adjusted for gestational age at birth and birth weight standard deviation score, was associated with the development of bronchopulmonary dysplasia (BPD). Another study done on ELBW babies reported a median PL of 83 (70.97) ml.[5] The authors proposed more restrictive blood sampling strategies and quality improvement methodology to reduce PL. We had only 2 ELBW babies in our study group. We minimized the PL in all the babies by judicious ordering of blood investigations, utilizing point-of-care tests, and avoiding overdraw of blood for sampling. We also strictly followed blood transfusion guidelines. As a result, we were able to minimize not only the PL but also blood transfusions.

Non-pharmacologic methods of reducing blood loss and prevention of anaemia in sick neonates have been emphasized earlier.[6,7] These include delayed cord clamping, cord blood sampling, non-invasive methods of screening, point-of-care testing devices, transcutaneous measurements etc. Adoption of these approaches will significantly reduce and even eliminate need for blood transfusions and exposure to blood products. Only one newborn needed packed red blood cell transfusion in our study. Lesser need of transfusion in our study could also be due to the variable population in our study which included newborns of all gestational age and birth weights.

Absolute blood loss due to phlebotomy was significantly associated with duration of hospital stay in sick neonates and did not significantly vary according to the birth weight and gestation in our study. The proportion of phlebotomy blood loss per kg body weight was significantly associated with birth weight, gestation and hospital stay. Iatrogenic blood loss should be acknowledged as a significant cause of anaemia in admitted sick neonates. Less arbitrary sampling, judicious blood investigations, avoiding overdraw of blood and micro sampling techniques can reduce the PL in such babies. Also, adhering to blood transfusion guidelines would simultaneously decrease the need for transfusions in sick neonates.

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