ASSESSMENT OF HAEMATOLOGICAL CHANGES DURING PUERPERIUM

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ABSTRACT

BACKGROUND

Puerperium is the period following childbirth during which the body tissues, especially the pelvic organs revert approximately to the pre-pregnant state both anatomically and physiologically. One of the main alterations that take place during pregnancy is increase in blood volume.

The objective of this study is to determine haematological changes before and after delivery.

MATERIALS AND METHODS

A hospital-based cross-sectional study was performed on a random sample of approximately 200 women undergoing vaginal delivery at district hospital in Belgaum.

RESULTS

At the time of admission it was found that 123 women had Hb < 12 gm% (61.5%), of whom 120 were mildly anaemic (8 - 12 gm%) (60%) and 03 were moderately anaemic (5 - 8 gm%) (1.5%) (pre-delivery mean corpuscular haemoglobin concentration was 31.86% and mean corpuscular volume was 94 cubic microns. A difference of 210.71 mL of mean blood loss was found in the primigravida as compared to multigravida.

CONCLUSION

Maximum reduction in haemoglobin, haematocrit and red blood corpuscles count occurred on 3rd post-partum day and that is the correct time to estimate blood indices.

KEYWORDS

Pregnancy, HB, HCT, Haemodynamic Changes, Puerperium.

BACKGROUND

Physiological changes during pregnancy facilitate the adaptation of cardiovascular system to the increased metabolic needs of the mother, thus enabling adequate delivery of oxygenated blood to peripheral tissues and the foetus.[1] Changes occur in circulating blood volume (affecting preload), peripheral vascular compliance and resistance (affecting afterload), myocardial function and contractility, heart rate and sometimes heart rhythm and the neurohormonal system.

One of the main changes that take place in pregnancy is increase in blood volume. Plasma volume increases progressively throughout normal pregnancy. On an average plasma volume increases about 50%, the total cell volume about 20% and total blood volume increases by 30%.[2] This results in physiological anaemia of pregnancy (haemoglobin (Hb) fall from 15 g/dL to 12 g/dL at 34 weeks). The blood volume returns to normal in 10 - 15 days after delivery.

Erythrocyte volume also increases from average non-pregnant volume of 1400 mL to about 1650 mL, an increase of 18% in a healthy pregnancy with normal diet due to accelerated production of red blood corpuscles (RBCs) rather than prolongation of life of RBCs. However, erythrocyte count falls from an average non-pregnant value of about 4.5 million/mm^3 upto a minimum of 3.7 million/mm^3 till 30 weeks. In healthy non-pregnant women, Hb concentration decreases from 13.7 to 14 gm% to an average of 11 gm% to 12 gm% of whole blood and haematocrit (Hct) value decreases from 40% to a minimum of 33% - 34% in the last ten weeks of pregnancy. Pregnancy usually induces a slight increase (2-3 fL) in mean corpuscular volume (MCV), independent of folate status and decrease in mean Hb concentration which is not more than 1 g/dL.

There are several methods to quantify post-partum blood loss. Those investigated include direct measurement using a number of collection devices and also indirect assessment with venous blood sampling, dye dilution techniques for plasma volume measurement, red blood cell and plasma volume determinations before and after delivery using radioactive tracer elements. Most of these methods have not been widely adopted, as they are not practical or not affordable in clinical setting. Routine estimation of pre- and post-partum Hb and Hct appear to be simple investigation that can provide an accurate assessment of the extent of blood loss. These will also permit the clinician to

plan management strategies, thereby preventing morbidity and mortality due to post-partum haemorrhage.

India has a Maternal Mortality Rate of 167/100000 live births.[3] Leading causes of maternal mortality and morbidity in our country is post-partum haemorrhage and underlying anaemia (25% - 30%). The routine health care provider assessment of post-partum blood loss is by visual estimation, who looks at the gross blood loss during delivery and makes a quantitative estimate of highly inaccurate.[4] Moreover, blood loss is not routinely recorded.

Visual estimation of blood loss during delivery by the health care provider is liable for subjective variation. Correlating the visually estimated amount of post-partum blood loss with Hb, Hct, other haematological and haemodynamic parameters will enable us to determine the severity of the blood loss. So the main objective is to determine haematological and haemodynamic changes before and after delivery.

MATERIALS AND METHODS

After obtaining the Institutional Ethical Committee clearance, the study was conducted at District Hospital, Belgaum. Around 200 women undergoing vaginal delivery during the study period were included in the study, after obtaining their informed consent. Planned or emergency caesarean section (placenta praevia, abruption placenta, pregnancy induced hypertension) Hb of less than 7 gm%, episiotomy, instrumental deliveries, those who received Intravascular (IV) fluids or blood and not willing to consent were excluded from the study.

Outcome measures included measurement of Hb, Hct before and after delivery, blood pressure and pulse rate before and after delivery. Measurement of blood loss by visual estimation; mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC) and RBC count before and after delivery. Serial Hb (Drabkin's Cyanmethaemoglobin method) and haematocrit (Wintrobe's method) measurements by venous blood sampling was performed for all study participants at the time of admission to labour ward. Serial Hb and haematocrit was done on day 1 (24 hours after delivery), day 3 (72 hours after delivery), MCV, MCHC, RBC count, pulse rate and blood pressure were the other parameters that were also recorded on these days. Data collection was done by using standardised, pre-tested questionnaires by the physician conducting the delivery. The same physician conducted haemodynamic assessment on all the days to avoid inter-related observer variability. Haematological parameters were estimated at the departmental laboratory.

Comparison in Hb and Hct values and other parameters between different groups were done by using unpaired 't' test and paired 't' test. Differences between two were considered significant when $p < 0.05$.

RESULTS

A total of 200 cases were studied to determine haematological and haemodynamic changes before and after delivery and to correlate the standardised visual estimate of blood loss with serial measurements of Hb and Hct, RBC count, pulse and blood pressure on day of delivery and post-partum day 1 and 3. In 19 cases out of the total 200 cases studied Hb, Hct and RBC values were not measured on the 3rd day, as they failed to adhere to the study and took voluntary discharge. Only two cases failed to comply on first day. These cases were treated as dropouts and not included in the analysis. At the time of admission, it was found that 123 women had Hb < 12 gm%, (61.5%) of whom 120 were mildly anaemic (8 - 12 gm%) (60%) and 03 were moderately anaemic (5 - 8 gm%) (1.5%).

Variables	Mean and SD
Haemoglobin (Hb) (gm%)	11.27 ± 1.42
Haematocrit (Hct) (%)	35.42 ± 4.41
Red Blood Corpuscles (RBCs) millions per cubic millimetre)	3.81 ± 0.56
Pulse (per minute)	81.27 ± 6.34
Blood Pressure	Systolic (mmHg)	120.14 ± 6.34
	Diastolic (mmHg)	77.11 ± 6.72

Table 1. Baseline Data- Day 0 (200 Subjects)

Variable	Values
Mean Corpuscular Haemoglobin Concentration (MCHC) (%)	31.86 ± 1.95
Mean Corpuscular Volume (MCV in cubic microns)	94 ± 12.15

Table 2. Blood Indices

In the present study, pre-delivery MCHC was 31.86% and MCV was 94 cubic microns.

Variables	Numbers
Gravida	G_1-7, G_2-112, G_3-59, G_4-21, G_5-1
Parity	P_0-7, P_1-114, P_2-60, P_3-18, P_4-1
Living children	L_0-12, L_1-124, L_2-50, L_3-13, L_4-1
Abortion	$A_1 - 6$

Table 3. Demographic Characteristics

In the present study, out of 200 subjects 7 were primigravida, 112 were gravida 2 and 81 were multigravida (gravida 3 and above). 114 were primipara and 19 were multipara (3 children and above). 124 women had at least one living and 14 had above 3 living children. Only 6 of the 200 women had one abortion.

Volume (mL)	Mean and SD
0-200 (92)	116.80 ± 46.74 mL
201-500 (67)	305.66 ± 77.98 mL
> 500 (22)	622.71 ± 233.73 mL

Table 4. Distribution of Blood Loss in Three Groups

Gravida Status	Blood Volume
Primigravida	480.71 ± 553.53
Multigravida (Above G_3)	270 ± 132.04

Table 5. Distribution of Blood Loss in Primigravida and Multigravida

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In the present study, a difference of 210.71 mL was found in the mean blood loss of primigravidas as compared to multigravidas. In comparison to multigravidas, primigravidas lost more blood.

DISCUSSION

Haematological parameters in the present study correlated with diagnostic indices in pregnancy with two authors who stated that Hb range is 11% to 12 gm%, and Hct value in the last weeks of pregnancy is between 33% - 34%. Red blood corpuscle count is 3.7 million/mm^3, mean Hb concentration is 32% - 33% and MCV is 93 - 95 μ^3. According to WHO definition, value of Hb at term should be at least 11.0 gm%.[5] In the present study Hb value was 11.27 gm%, haematocrit was 35.42%, RBC was 3.81 million/mm,^{3} MCV was 93.92 μ^3 and MCHC was 31.86%.[6]

Haemodynamic parameters such as systolic blood pressure of 110 mmHg – 120 mmHg and diastolic blood pressure of 75 mmHg to 85 mmHg is comparable with present findings of 120.14 mmHg and 77.11 mmHg. In the present study, pulse rate of 81.27/ min correlated with 70 - 100/ min.

Present study indicates that greater the peak reduction of Hb and Hct percentage, greater is the blood loss. Above 15%, reduction on third day may suggest post-partum haemorrhage. Upto 12% reduction in either of the indices may suggest blood loss of less than 500 mL. However, reduction of 10% Hb and 9% reduction of Hct on first day itself may suggest post-partum haemorrhage.

Standardised visually estimated blood loss in present study was 249.28 mL, which is comparable with two different studies, which showed 244.30 mL and 263.81 mL.[7,8]

Distribution of Blood Loss in Primi and Multigravida

According to three different studies the factors leading to increased blood loss, multigravidas lost more blood than primigravidas. But, in the present study where estimated blood loss in primigravidas was considerably higher than multigravidas as demonstrated in two different studies,[7,8] which may be partly related to longer time taken to repair episiotomies. A difference of 210.71 mL was found in mean blood loss of primigravidas as compared to multigravidas in the present study. Correct timing and prompt repair will minimise blood loss. Blood loss in primigravida was 480.71 ± 550.53 and 270 ± 132.04 in multigravidas.

Postpartum Haematological Changes

Out of the total 200 cases studied, Hb, packed cell volume, RBC count was not done in 19 cases and they were excluded from the analysis, as the subjects left on first day (2 cases) (AMA) and 3rd day (17 cases) before completing the study and were considered as dropouts. Out of the 181 cases analysed a significant reduction in Hb, packed cell volume and RBC count was seen post-delivery and maximum reduction was on the 3rd day postpartum.

The present study observed changes in Hct values are mainly the result of changes in plasma volume, a fall in Hct value reflecting the expansion of plasma volume. This data was in agreement with studies of three different authors,[9,10,11] which suggest that the appropriate time to measure Hb and Hct is on the 3rd post-partum day, as this is the time when volume overload of pregnancy is lost and an accurate idea of blood loss can be estimated.

Rate of fluid administration and continued vaginal bleeding in post-partum period are other two factors that play a role in this response. Rapid administration of fluid and little blood loss in post-partum period results in more immediate fall in Hct, whereas slow administration of fluid and continued blood loss in post-partum period results in a prolonged fall in Hct. Therefore, it can be stated that no single timed Hct determination in the first 24 hours of post-partum will detect the peak reduction in majority of patients, which was in agreement with the previous studies.

CONCLUSION

Maximum reduction in Hb, Hct and RBC count occurred on 3rd post-partum day and that is the correct time to estimate blood indices. MCHC decreases and MCV increases significantly on first day post-partum, but not on third day. Pulse rate and systolic blood pressure reduced significantly on first day and third day post-partum. A significant fall in diastolic blood pressure is seen only on third day.

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