POSTPARTUM PERIOD- A WINDOW OF OPPORTUNITY FOR ANAEMIA CORRECTION
Hema Divakar1, Priti Kumar2, Kavita Bansal3, Pragya Tripathi4, Shelly Dutta5, Isaac Manyonda6

1Chief Consultant, Department of Obstetrics and Gynaecology, Divakars Speciality Hospital, Bangalore.
2Consultant Gynaecologist, Department of Obstetrics and Gynaecology, Sunflower Medical Centre, Lucknow.
3Consultant Gynaecologist, Department of Obstetrics and Gynaecology, Fatima Hospital, Lucknow.
4Consultant Gynaecologist, Department of Obstetrics and Gynaecology, Kanti Kuber Hospital, Bahraich.
5Biotech Research Assistant, Divakars Speciality Hospital, Bangalore.
6Honorary Professor, Department of Obstetrics and Gynaecology, St. George’s University of London.

ABSTRACT

BACKGROUND
The aim of the study is to determine the prevalence of anaemia after delivery and highlight the need for postpartum anaemia services in India.

MATERIALS AND METHODS
Women were recruited at admission for delivery; excluded were mothers with non-iron-deficiency anaemia, haematological disease or who had preterm deliveries. Hb levels were measured at admission for delivery and 24-hours postpartum. An estimate of the number of women with Hb less than 10 g/dL that would qualify for parenteral iron therapy was made.

RESULTS
221 (67.03%) women had vaginal births, while 466 (32.96%) women had C-sections. The prevalence of severe anaemia, moderate anaemia and mild anaemia increased between the two study points from 0.43% to 1.74% (McNemar=0.021), 8.01% to 11.21% (McNemar=0.0021) and 60.12% to 69.58% (McNemar <0.001), respectively. The proportion of women who did not have anaemia decreased from 31.44% to 17.47% (McNemar <0.001). Hb levels at 24 hours postpartum were lower in 553 women (80.49%).

CONCLUSION
We showed that the prevalence of mild, moderate and severe anaemia increase after delivery. Furthermore, vaginal birth and C-section are associated with decreases in Hb. The study highlights the need to institutionalise postpartum anaemia correction services in India to reduce postpartum anaemia prevalence and improve the quality of maternal care.

Tweetable abstract- The prevalence of mild, moderate and severe anaemia increase after vaginal birth or C-section.

KEYWORDS


BACKGROUND
Iron deficiency is one of the most prevalent nutritional deficiencies in the world: affecting an estimated two billion people. Although, it disproportionately affects young children, pregnant women and postpartum women. Iron deficiency is endemic in regions where poor diets and/or infections associated with blood loss are prevalent. Iron deficiency is the most significant contributing factor of anaemia accounting for at least half of all reported cases. Among pregnant women, the global incidence of anaemia is 38% with pregnant women in South-East Asia, the Eastern Mediterranean and Africa having the highest anaemia burden. In India, the prevalence of anaemia among pregnant women falls between 37-67% with Iron-Deficiency Anaemia (IDA) being the most common form. Anaemia during pregnancy is defined as a haemoglobin concentration of less than 11.0 g/dL in the first and third trimesters and a haemoglobin concentration of less than 10.5 g/dL in the second trimester. It is correlated with premature birth and low birth weight of the newborn. Furthermore, it is one of the strongest predictors of postpartum anaemia, which is conservatively defined as a haemoglobin concentration of less than 11 g/dL at childbirth and during the subsequent 6 weeks. Postpartum anaemia can impair maternal functioning and health, affecting physical performance, mood, cognition and the immune response. These symptoms may, in turn, interfere with...
the mother-child interactions, negatively affecting infant development and behaviour.\textsuperscript{13,15}

Iron supplementation with oral iron therapies has been indicated for the treatment and prevention of maternal anaemia (WHO, 2015).\textsuperscript{16} In India, this has been achieved through initiatives such as Janani Suraksha Yojana\textsuperscript{17} and Janani Shishu Suraksha\textsuperscript{18} that have improved access to antenatal care including anaemia screening and treatment. These programs, however, focus on iron deficiency during the antenatal period; postpartum estimation of haemoglobin levels and postpartum iron deficiency correction are not routine practice.

In order to inform anaemia eradication programs in India that are targeted at pregnant and lactating women, the goal of this present study was to determine and compare the prevalence of mild, moderate and severe anaemia in women attending rural, urban and semi-urban hospitals in India in postpartum periods and prior to delivery. Furthermore, by comparing the changes in haemoglobin levels of women within each of the categories and determining the effect that vaginal and Lower Uterine Segment Caesarean Section (LSCS) deliveries have on haemoglobin concentration, this study hopes to draw attention to the need for correction of postpartum anaemia before women are discharged, which would result in women leaving the medical facilities with the required amount of elemental iron in their systems.

MATERIALS AND METHODS

Design

This was a multicenter study conducted with institutional review board approval over a period of 6 months from May 2016 to October 2016. 687 patients attending the obstetric departments of urban, semi-urban and rural hospitals in India took part in the study. The study participants were recruited from Divakars Specialty Hospital, Bangalore; Sunflower Medical Centre, Lucknow; Fatima Hospital, Lucknow; and Kanti Kuber Hospital, Bahraich.

Study Subjects

Women were recruited at admission for delivery at term and the details of the study were explained to each mother in English or the native language. Informed consent was obtained thereafter through a signature.

We included all pregnant women who were 18 years old or older, irrespective of whether they had been treated for IDA with oral/parenteral iron therapies or not. We excluded women who had anaemia that was the result of conditions other than iron deficiency (e.g. vitamin B12 or folate deficiency, infection, chronic bleeding or renal failure). Women with anaemia due to haemoglobinopathies or who had preterm deliveries were also excluded.

Haemoglobin concentration was estimated by collecting a blood sample via finger prick and applying it to a HemoCue (Hb analyser). For each study participant, measurements were obtained at two time points- at admission for delivery and 24-hours postpartum.

Statistics

All statistics were done using IBM SPSS (statistics version 22). The change in Hb, mean change in Hb and Standard Deviation (SD) were determined; percentages were computed for categorical values. The McNemar test was conducted to compare the prevalence of severe, mild and moderate anaemia at admission for delivery and 24 hours postpartum. p<0.05 was considered significant.

RESULTS

Six hundred and eighty seven women participated in the study. All women followed up and their demographics as well as baseline anaemia severity at the beginning of the study are shown in Table 1.

<table>
<thead>
<tr>
<th>Baseline Characteristic</th>
<th>At term (n=687)</th>
</tr>
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<tbody>
<tr>
<td>Age (y)</td>
<td>27.35 (±4.49)</td>
</tr>
<tr>
<td>Hg (g/dL)</td>
<td>10.52 (±1.38)</td>
</tr>
<tr>
<td>Hg category (g/dL, %)*</td>
<td></td>
</tr>
<tr>
<td>&gt;11.00 (Non-anaemic)</td>
<td>216 (31.44)</td>
</tr>
<tr>
<td>9.00-11.00 (Mild anaemia)</td>
<td>413 (60.12)</td>
</tr>
<tr>
<td>7.00-8.90 (Moderate anaemia)</td>
<td>55 (8.01)</td>
</tr>
<tr>
<td>&lt;6.90 (Severe anaemia)</td>
<td>3 (0.43)</td>
</tr>
</tbody>
</table>

*Table 1. Baseline Demographic Variables of Enrolled Participants

Values are mean (±SD) unless indicated otherwise.

Mean haemoglobin concentrations at admission for delivery and 24-hours postpartum were 10.52±1.38 g/dL and 10.15±3.93 g/dL, respectively. As shown in Table 2, the prevalence of severe anaemia increased between the two study points from 0.43% to 1.74% (McNemar=0.021), the prevalence of moderate anaemia increased from 8.01% to 11.21% (McNemar=0.0021) and the prevalence of mild anaemia increased from 60.12% to 69.58% (McNemar <0.001). Furthermore, the proportion of women who did not have anaemia decreased from 31.44% to 17.47% (McNemar <0.001).

Furthermore, between admission for delivery and 24-hours postpartum, 66.20% (143/216) of non-anaemic women became anaemic, 7.26% (30/413) of mildly anaemic women became moderately anaemic and 12.72% (7/55) of moderately anaemic women became severely anaemic (Table 3). The average drop in haemoglobin concentration for women who registered a change in anaemia category was 1.21±1.41 g/dL for non-anaemic women who became anaemic, 2.04±2.01 g/dL for mildly anaemic women who became moderately anaemic and 2.13±1.71 g/dL for moderately anaemic women who became severely anaemic (Table 3). Overall, the haemoglobin concentration at 24-hours postpartum dropped in 553 women (80.49%).

Overall, 221 (67.03%) women had a vaginal birth, while 466 (32.96%) women had LSCS. As shown in Table 3, of those women who experienced a change in anaemia category after giving birth, 119 women (67.039%) had LSCS, while 60 women (32.96%) had a normal delivery. Furthermore, the average drop in haemoglobin levels was 1.35±1.65 g/dL for women who had a vaginal delivery and 1.46±1.44 g/dL for women who had LSCS.
Furthermore, India contributes almost 36% of all maternal mortality in Asia.\textsuperscript{22} In order to correct anaemia in the antenatal periods, deworming, diet advice and oral iron and parenteral iron are recommended.\textsuperscript{17-18} However, these efforts are limited by the lack of follow-up among low-income women who often have to travel long distances to access public health facilities\textsuperscript{23-24} and the challenges associated with the use of oral and parenteral iron therapies. Oral iron therapies are plagued by non-compliance,\textsuperscript{25} while conventional parenteral iron therapies, such as iron sucrose, often require women to make multiple trips to medical facilities.\textsuperscript{26-27}

This study highlights not only the urgent need for anaemia screening and management during the antenatal period, but also underscores a need to extend postnatal care to women by providing services that will correct conditions like postpartum anaemia. Furthermore, it indicates that women who have vaginal births should not be overlooked—we found that, regardless of mode of delivery, a drop in haemoglobin levels was observed 24-hours postpartum and it was comparable between women who had a vaginal birth and those who had an LSCS delivery. Furthermore, in 179 women, it was enough to worsen anaemia status. Given the follow-up challenges among low-income women\textsuperscript{26} and the challenges associated with oral and first and second generation parenteral iron therapies, Ferric Carboxymaltose (FCM), an effective intravenous iron therapy that can be delivered as a single dose over a period of 15 minutes should be considered.\textsuperscript{25,29-30} In a separate study,\textsuperscript{31} we found that a single dose of 500 mg FCM administered 24-hours postpartum was safe and effective in treating postpartum anaemia successfully increasing overall haemoglobin levels to 12.0 g/dL in 57% of study participants within 6 weeks. The current structure of maternal services in India presents an opportunity to manage postpartum anaemia as anaemic women can be given FCM to correct anaemia while they are still in the medical facility, which will ensure that they leave the medical facility with adequate iron in their systems.

Our study is not without limitations. The study was not powered to detect significant differences between vaginal delivery and LSCD and the HemoCue that was used to determine Hb concentrations has been known to overestimate haemoglobin values;\textsuperscript{32-24} however, since the same HemoCue was used to measure Hb levels at admission and 24-hours postpartum, any errors were minimised. Furthermore, we did not record the number of women who might have had delivery complications that might have affected the Hb levels postpartum and the inclusion of women who were receiving oral/parenteral iron therapies might have reduced the prevalence we observed.

**CONCLUSION**
We showed that the prevalence of mild, moderate and severe anaemia increase after delivery. Furthermore, both vaginal birth and C-section are associated with decreases in haemoglobin levels. This study highlights the need to incorporate postpartum anaemia correction services as routine parts of antenatal counseling and postnatal services in India. Institutionalisation of the correction of postpartum anaemia in India with provision of parenteral iron provides
yet another opportunity to improve the quality of maternal and child health.

REFERENCES


