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Original Research Article

Fetomaternal outcomes in antenatal women with sickle cell hemoglobinopathies: an observational study from central India

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ABSTRACT

Background: Sickle cell hemoglobinopathies, especially prevalent in tribal populations of central India, pose significant obstetric and neonatal risks. Early recognition and high-risk pregnancy management are essential in minimizing complications. Objective was to analyze fetomaternal and labor outcomes in antenatal mothers with sickle cell hemoglobinopathies (SCD and SCT) attending a tertiary care center in Chhattisgarh.
Methods: A hospital-based prospective observational study was conducted at RIMS, Raipur, over 18 months. A total of 75 antenatal women in the third trimester diagnosed with sickle cell hemoglobinopathies were enrolled. Clinical data on maternal (anemia, PIH, ICU stay), fetal (birth weight, NICU admission, Apgar scores), and labor outcomes (gestational age, delivery mode) were collected and analyzed using SPSS v28.0.
Results: Out of 75 participants, 93.3% had sickle cell trait (HbAS) and 6.6% had sickle cell disease (HbSS). Anemia was present in 65.3% (mild in 40%, moderate in 18.7%, severe in 6.6%). PIH occurred in 13.3%, and 2.7% required ICU admission. No postpartum hemorrhage or maternal mortality was noted. LBW was observed in 45.3%, NICU admission in 17.3%, Apgar<7 at 1 minute in 18.7%. Cesarean section was performed in 77.3% of cases, and preterm birth occurred in 22.7%.
Conclusions: Sickle cell hemoglobinopathies are associated with a high burden of maternal anemia, hypertensive disorders, and adverse neonatal outcomes. Enhanced antenatal surveillance, multidisciplinary care, and community-based screening are recommended to improve outcomes in high-prevalence regions.

Keywords: Anemia, Chhattisgarh, Neonatal outcomes, Pregnancy, Sickle cell disease, Trait

INTRODUCTION

Sickle cell hemoglobinopathies, encompassing both sickle cell trait (SCT) and sickle cell disease (SCD), are monogenetic haematological disorders that are caused by autosomal recessive inheritance of a single base A>T mutation in the triplet encoding the sixth residue of the β-globin chain, leading to a substitution of valine for glutamic acid at position 6 of the β-globin chain of the normal hemoglobin.[1] These mutations increase Hb polymerization in RBCs, forcing them into a sickled shape, and lead to increased vascular blockage and hemolytic crisis in SCD patients.[2]

SCD is perceived as a global threat by the World Health Organization, and about 5% of the world population and more than 7% of pregnant women worldwide suffer from hemoglobinopathies such as SCD.[3,4] The prevalence is especially high in states like Chhattisgarh, Odisha, Madhya Pradesh, Gujarat, and Maharashtra, particularly among tribal populations.[5] In Chhattisgarh, the carrier rate of SCT among tribal communities can exceed 30%.[6]

Pregnancy in women with SCD poses major challenges. The physiological changes of pregnancy- such as increased plasma volume, cardiac output, and oxygen demand- can exacerbate the underlying hemoglobinopathy and

contribute to complications such as vaso-occlusive crises, preeclampsia, anemia, infections, and acute chest syndrome.[7,8] These pathophysiological mechanisms often culminate in adverse maternal outcomes like severe anemia, ICU admissions, and increased cesarean rates. Fetal complications include intrauterine growth restriction (IUGR), low birth weight, preterm delivery, and higher NICU admissions.[9]

Given these concerns and the regional burden of disease, this study was conducted to evaluate the fetomaternal outcomes in antenatal women with sickle cell hemoglobinopathies at Raipur Institute of Medical Sciences (RIMS), Chhattisgarh. The findings aim to guide clinicians in managing high-risk pregnancies with SCD in endemic areas.

METHODS

Study design

It was a prospective, hospital-based observational study.

Study setting

The study took place at the department of obstetrics and gynecology, Raipur Institute of Medical Sciences, Raipur, Chhattisgarh.

Duration

The study was carried out from June 2023 to December 2025.

Sample size

75 antenatal women diagnosed with sickle cell hemoglobinopathies were included in the study.

Inclusion criteria

Third-trimester pregnant women with confirmed SCD or SCT by Hb electrophoresis consenting participants were included in the study.

Exclusion criteria

Patients with chronic hypertension, renal failure, autoimmune disorders multiple gestation. Non-consenting patients.

Data collection

Participants were monitored from 29 weeks until delivery. Maternal outcomes (anemia, PIH, PPH, ICU stay), fetal outcomes (birth weight, Apgar score, NICU admission), and labor outcomes (gestational age, mode of delivery) were recorded.

Statistical analysis

SPSS v28.0 was used. Descriptive statistics, Chi-square, t-test/Mann-Whitney U, and repeated measures ANOVA were applied. A p value <0.05 was considered significant.

RESULTS

Demographics and genotype distribution

Mean age: 26.2 years (range 18-35).

The data reveals that distribution of age among participants showing majority of pregnant women were aged 25-30 years (37.33%) and 31-35 years (36%). Youngest group (18-20 years) made up 16%; 21-25 years: 10.67%.

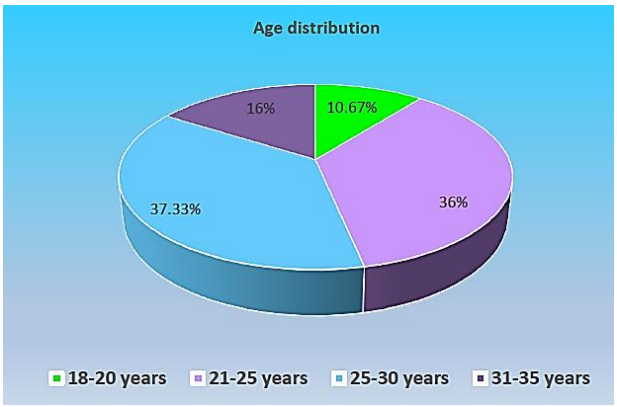

Figure 1: Age distribution among participants.

The data reveals that electrophoretic pattern (genotype) among participants in which majority of participants had sickle cell trait (92%), whereas only a small fraction had sickle cell disease (6.67%).

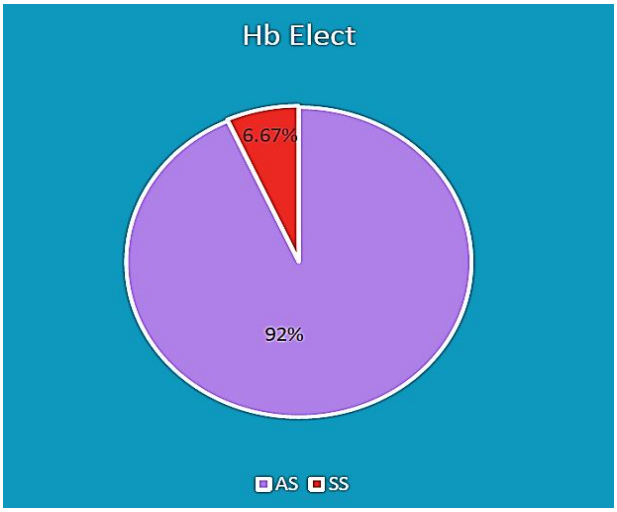

Figure 2: Distribution of pregnant women according to electrophoretic pattern.

Maternal complications

Anemia: mild (40%), moderate (18.7%), severe (6.6%).

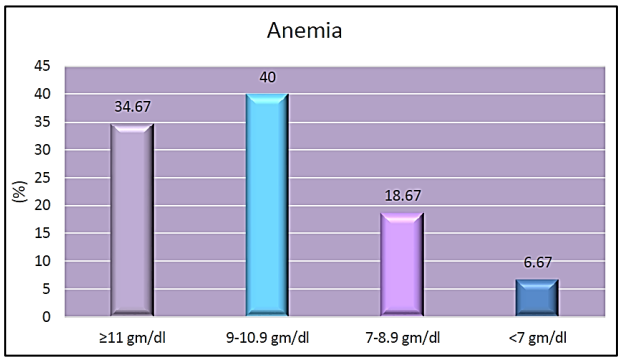

Figure 3: Levels of anemia among the participants.

The data shows a high burden of anemia among the study population with 65.3% affected, whereas only 34.7% had normal hemoglobin levels.

PIH/eclampsia: 13.3%.

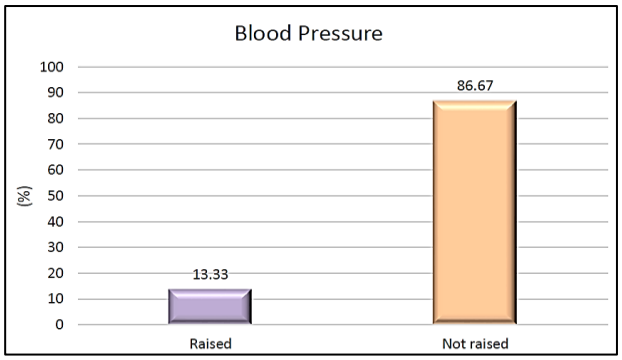

Figure 4: Blood pressure levels were assessed among participants.

The data reveals hypertensive disorders were seen in 13.33%, whereas the majority (86.67%) maintained normal blood pressure.

ICU admission: 2.7%.

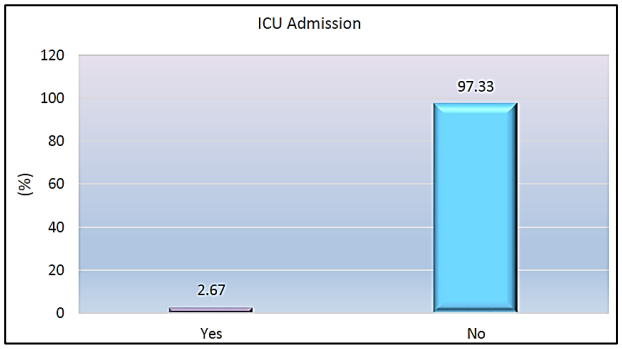

Figure 5: ICU admission among participants.

The data reveals that need for ICU care was minimal (2.67%), whereas 97.33% of women did not require intensive care.

Fetal outcomes

LBW (<2.5 kg): 45.3%.

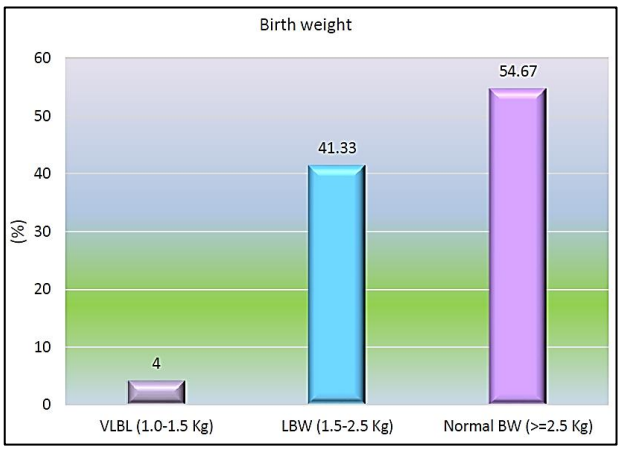

Figure 6: Foetal birth weight among participants.

The data reveals that among participants, 45.3% of the babies were born with low birth weight, whereas 54.67% had a normal birth weight.

NICU admission: 17.3% (majority due to ARDS).

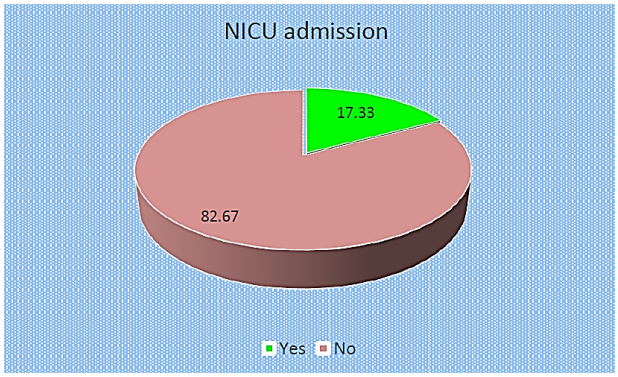

Figure 7: NICU admission among participants.

The data reveals that NICU admission was required in 17.33% of cases, whereas 82.67% of newborns did not need NICU care.

Table 1: Apgar score at 1 minute after birth.

	<7	>7	Total
APGAR 1 minute	14	61	75
APGAR 5 minutes	1.33	98.6	75

The above data reveals that at 1 minute, 18.7% of newborns had an Apgar score <7, whereas by 5 minutes, nearly all (98.6%) had improved scores >7.

Labor outcomes

Cesarean section: 77.3%.

Table 2: Mode of delivery among participants.

Mode of delivery	Number	Percentage
VD	17	22.67
LSCS	58	77.33
Total	75	100

The above data reveals that cesarean sections were performed in 77.3% of cases, whereas only 22.7% had vaginal deliveries.

Preterm delivery: 22.7%, term delivery: 77.3%.

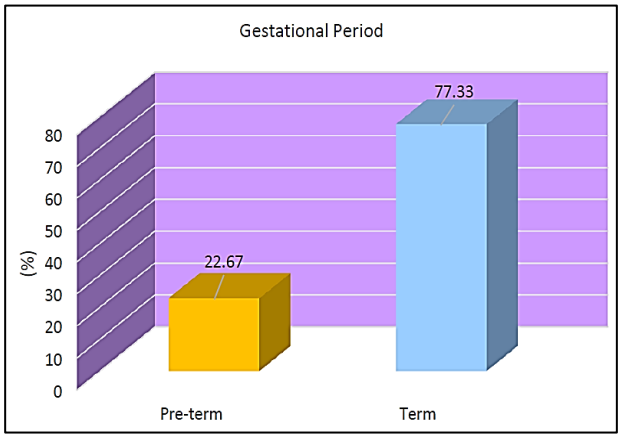

Figure 8: Period of gestation at the time of delivery among participants.

The above data reveals most deliveries occurred at term (77.3%), whereas 22.7% were preterm births.

DISCUSSION

The present prospective observational study, conducted on 75 antenatal women with sickle cell hemoglobinopathies (SCT and SCD), provides valuable insight into fetomaternal outcomes in a high-prevalence area.

Figure 1 shows the distribution among participants in which majority of participants were aged between 25-30 years (37.33%), followed closely by those aged 31-35 years (36%).

Figure 2 shows distribution of pregnant women according to electrophoretic pattern, 92% of women were identified with sickle cell trait (HbAS), while 8% had sickle cell disease (HbSS)

Figure 3 shows anemia was the most prevalent complication, with 59.34% of women showing hemoglobin levels below 11 gm/dl. Severe anemia (<7 gm/dl) was noted in 6.66%, necessitating blood transfusions in several cases. These findings align with previous studies by D'Couth et al and Desai et al, which reported anemia in over 70% of pregnant women with SCD.[10,11]

Figure 4 shows hypertensive disorders occurred in 13.33% of cases, consistent with the findings of Aghamolaei et al, who found a higher prevalence of pregnancy-induced hypertension and preeclampsia among SCD patients.[12] D'Couth et al found an increased risk of obstetric complications, including gestational hypertension (16%), preeclampsia (11.11%), and eclampsia (5.56%).[10]

Figure 5 shows 2.67% of women required ICU admission, and notably, there were no cases of postpartum hemorrhage. Basu et al, which emphasizes the need for multidisciplinary approaches in managing pregnancies complicated by sickle cell disease, which may contribute to positive outcomes like the absence of PPH.[13] This could be attributed to close monitoring and proactive antenatal management at the tertiary center.

Figure 6 shows that low birth weight (LBW) was observed in 45.3% of neonates. Preterm deliveries accounted for 22.67%, while NICU admission was required for 17.33%, mostly due to acute respiratory distress syndrome (ARDS). These findings mirror those from a study by D'Couth et al, where LBW was noted in over 56% of cases and NICU admission in 31.88%.[10] Sharma et al, emphasize the increased risk of adverse maternal and fetal complications, including placental insufficiency, preterm labor, and intrauterine growth restriction (IUGR), all of which can contribute to lower birth weights.[14]

Figure 7 shows NICU admission among participants shows 82.67% needed NICU admission while 17.33% did not need NICU admission.

A statistically significant association was observed between HbSS genotype and NICU admission ($p=0.009$), as well as between preterm birth and NICU admission ($p<0.001$). These associations reinforce the known increased fetal risk in SCD pregnancies, as highlighted by Ganesh et al and Rajauria et al.[15,16]

Table 1 shows Apgar score,18.7% of neonates had a score <7 at 1 minute, suggesting initial neonatal depression. However, 1.33% had a score <7 at 5 minute.

Table 2 shows cesarean delivery rate was high (77.33%), often indicated due to fetal distress and maternal complications. This is notably higher than the general obstetric population and corresponds with studies conducted in tribal populations of India.[11] Similar to the study done by Rey et al, they found that elective LSCS may be preferred in certain cases to minimize risks associated with vaginal delivery, particularly in patients with severe disease manifestations or those who have experienced prior complications during pregnancy.[17]

In Figure 8, preterm delivery was observed in 22.7% of participants, while term delivery occurred in 77.3%. Preterm birth is a known complication in pregnancies affected by hemoglobinopathies.

Interestingly, despite a high anemia burden, ICU admissions and febrile complications were low, possibly reflecting effective ANC interventions like multidisciplinary approach, high dose folic acid supplementation, low dose aspirin, blood transfusion for severe anemia, pain management, hydration, postpartum monitoring and thromboprophylaxis.[18-23] The absence of maternal mortality is encouraging and underlines the benefit of institution-based delivery and early high-risk identification.[24,25]

Summary

In antenatal women with sickle cell hemoglobinopathies, there is increase adverse fetomaternal outcome. Cesarean delivery is increased in antenatal women with sickle cell hemoglobinopathies.

CONCLUSION

Sickle cell hemoglobinopathies significantly impact fetomaternal health. Routine hemoglobinopathy screening during early ANC, proper nutritional and hematologic support, and timely obstetric interventions are essential. A multidisciplinary approach involving obstetricians, physician, and neonatologists can reduce morbidity and improve outcomes.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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