Perinatal Course in Pregnant Women With Sickle Cell Anemia and Outcomes in Neonates Born to Them

Aarti Mukeshbhai Dalwani*, Sheila Gangadharan Aiyer

Abstract

Background: The incidence of sickle cell anemia (SCA) is predominantly high in the tribal population in Gujarat (India). Women with SCA develop complications during pregnancy.

Aim: To compare maternal complications observed during perinatal course in pregnant women with SCA and outcomes in neonates born to them

Materials and Methods: This prospective, observational study was conducted at a tertiary care institutional hospital from February to August 2017. The study enrolled 150 pregnant women: 75 each in the study and control groups. Pregnant women, belonging to various tribal communities, who tested positive in sickle solubility test were included in the study group. From the same communities, pregnant women who tested negative in sickle solubility test were included in the control group. Maternal and neonatal data from the beginning of the study till discharge were entered in a predesigned proforma. These data were statistically analyzed.

Results: We found that during perinatal period, the difference between packed cell volume requirement and other antenatal complications was significant between the 2 groups. There were no significant differences in the neonatal outcomes and overall well-being of neonates in both the groups. However, the neonates born to women in the study group had a longer NICU stay compared with those born to women in the control group.

*Correspondence

Dr Aarti Mukeshbhai Dalwani
Consultant Pediatrician
Department of Pediatrics and Neonatology
Shalby Hospitals Private Limited
Haridarshan Cross Road
Kathwada Road, Naroda
Ahmedabad 382325, Gujarat
India

E-mail: dalwaniaarti@gmail.com

Conclusion: Based on our observations, providing appropriate antenatal and intranatal care to pregnant women with SCA will help avoid perinatal complications and outcomes in their neonates.

Key Words: Sickle cell disease, sickle cell trait, perinatal outcome, neonatal outcome, tribal women, antenatal complications, NICU stay

Introduction

Majority of the population in tribal communities, such as Dhodhia, Dubla, Gavit, Chaudhary, Tadvi, Rathod, Kolcha, and Bariya, found in Gujarat (India) is highly prone to sickle cell anemia (SCA). As SCA is a genetic disease, a high prevalence of this genetic variant is observed in the tribal population. Approximately 30% of those with SCA die before they reach adulthood (14 years) and the rest die by the age of 50 years.[1] According to a survey conducted by the Indian Council of Medical Research in 2015, the prevalence of the sickle hemoglobin (HbS) gene in the tribal population of Gujarat is 5% to 34%.[2] This condition is hereditary, and the defective gene leads to the production of HbS. The HbS gene tends to polymerize upon desaturation, which results in the formation of sickle-shaped RBCs that cause vaso-occlusion and hemolysis.[3-5] Women with SCA are considered to have high-risk pregnancies due to poor perinatal outcomes.[6] Neonates born to pregnant women with SCA require special attention, as chances of low birth weight and prematurity are high due to uteroplacental insufficiency.[4,7] If outcomes and morbidities in neonates born to pregnant women with SCA are known, screening can be done in the early neonatal period so that treatment can be started immediately to avoid complications in the later stage of life.[8-13]

Aim

This study was conducted to

- evaluate the risk factors in women with SCA that can lead to perinatal complications and poor outcomes in neonates born to them and compare with that of the control group.
- analyze the conditions, provide appropriate care, and take measures to circumvent the risk, especially in high-risk mother–neonate pairs.

Materials and Methods

Study design

This prospective, observational study was conducted for 6 months (from February to August 2017) at a level 3 NICU attached to the labor room in Sir Sayajirao Gaekwad (SSG) Hospital (Vadodara, Gujarat, India). The study was approved by the hospital's Institutional Ethics Committee on Human Research.

The study enrolled 150 mothers belonging to different tribal communities (75 in the study group and 75 in the control group) after obtaining their written consent.

Inclusion criteria

For the study group: Pregnant women with SCA (both sickle cell disease [SCD] and sickle cell trait [SCT]) and neonates born to them, from different tribal communities

For the control group: Pregnant women without SCA and neonates born to them, belonging to the same tribal communities as that of the women in the study group

Study procedure

Pregnant women in both the groups were compared for various maternal parameters such as age, residential area, antenatal care (ANC), supplements taken, hemoglobin, packed cell volume (PCV) requirement, and other peripartum complications that can affect perinatal outcomes.

Outcomes such as birth weight, maturity, NICU stay, and other morbidities such as asphyxia, respiratory distress syndrome, sepsis, and jaundice were compared between neonates born to women in the study and control groups. The outcomes were also compared between neonates born to women with SCD and SCT.

Results

SSG Hospital is a tertiary care hospital and referral center located at Vadodara (Gujarat, India). Patients from nearby districts such as Panchmahal, Dahod, and Chhota Udaipur are referred to this center. During our 6-month study, 2964 deliveries were conducted. Average deliveries per month were 495. Of the 2964 pregnant women, 82 had SCA, of which 75 were enrolled in the study group based on the inclusion criteria. Of these 75 women, 60 had SCT and 15 had SCD (Figure 1, Table 1).

In our study, 10 maternal parameters (ie, maternal age, ANC received or not, number of ANC visits, obstetric history, history of abortion, maternal weight, maternal Hb level, PCV requirements, type of delivery, and complications in the antenatal period) that can affect perinatal outcomes were compared between the study and control groups. Both the groups were comparable in terms of age, ANC received, weight, and obstetric history. During the antenatal period, the pregnant women in the study group were counseled regarding lowering their threshold for seeking medical care. The difference between PCV requirement and other antenatal complications was significant between the groups.

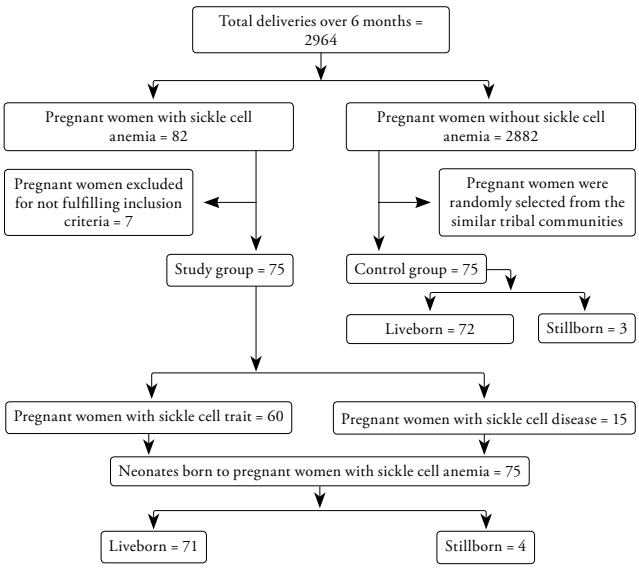

Figure 1. Categorization of Participants in the Study and Control Groups and Outcomes of Their Neonates

Table 1. Comparison of Maternal Parameters Between the Study and Control Groups

Parameter	Range	Average (Study Group)	Average (Control Group)	*P* Value
Maternal Age, y	20–35	23.94	24.76	.5183 (not significant)
Number of ANC Visits	0–5	3.9	3.1	.005 (significant)
Location of ANC	Anganwadi	3	14	.0019 (significant)
	Tertiary care centers	24	17	
Obstetric History	0–5	1.6	1.9	.5412 (not significant)
History of Abortion	0–2	0.146	0	.5412 (not significant)
Maternal Weight at the Time of Conception, kg	< 40 to > 60	48.6	47.52	.4373 (not significant)
Maternal Hb Level During the Peripartum Period, g/dL	< 7 to > 10	8.17	8.5	.2143 (not significant)
PCV Requirement During the Perinatal Period	1 unit	11	3	< .0001 (significant)
	≥ 2 units	14	1	
Other Complications During the Antenatal Period	Present	40	22	< .0001 (significant)
	Absent	35	53	
Type of Delivery	Vaginal	51	61	.0911 (not significant)

ANC, antenatal care; PCV, packed cell volume.

In the control group, only 1% of the pregnant women had received ANC > 5 times, while in the study group, 10.67% of the pregnant women had received ANC as shown in Table 2. Further, 26.67% of the pregnant women with SCD had received ANC > 5 times. As the pregnant women in the study group were counseled about their sickling status and its effect on pregnancy, they took appropriate care during the antenatal period,

Table 2. Categorization of Number of ANC Visits

ANC Visit	SCT (*n* = 60), *n* (%)	SCD (*n* = 15), *n* (%)	Study Group, *n* (%)	Control, *n* (%)
0	1 (1.67)	1 (6.67)	2 (2.67)	4 (5.33)
1	2 (3.33)	0 (0)	2 (2.67)	8 (10.67)
2	8 (13.33)	1 (6.67)	9 (12)	12 (16)
3	9 (15)	4 (26.67)	13 (17.33)	19 (25.3)
4	15 (25)	4 (26.67)	19 (25.33)	23 (30.67)
5	21 (35)	1 (6.67)	22 (29.33)	8 (10.67)
> 5	4 (6.67)	4 (26.67)	8 (10.67)	1 (1.33)
	Significance level *P* = .00945 (s)		Significance level *P* = .0058 (s)	

ANC, antenatal care; SCD, sickle cell disease; SCT, sickle cell trait.

which reflected in their perinatal outcome. As the pregnant women in the study group were educated about their condition and associated complications, the proportion of the women who sought ANC was high. The pregnant women with SCT and SCD were monitored for their Hb level and end-organ damage. Also, they were given early transfusions, if required, and continuous folic acid supplementation.[14]

As the pregnant women in the study group sought ANC, complications such as oligohydramnios, eclampsia, and severe anemia could be prevented. Hence, the number of neonates with prematurity, intrauterine growth restriction, and low birth weight were not significantly higher in the study group compared with those in the control group.

In the study group, 17.8% of the pregnant women received ANC from private hospitals, and 32.87% received ANC from tertiary care hospitals. In the control group, only 23.8% of the pregnant women received ANC. Of the 23.8% of pregnant women, 18.6% received ANC at anganwadis (mother and child care centers in rural areas in India), and the remaining received ANC from tertiary care hospitals.

In the study group, 4.1% of the 32.87% pregnant women with SCA visited an anganwadi for ANC, but in the control group, 19.18% received ANC from an anganwadi.

This suggests that counseling about complications that occur because of SCA during pregnancy encouraged the pregnant women to approach a proper health care setup for ANC and avoid perinatal complications ($P < .05$).

Perinatal outcomes

In the control group, 4% of the pregnant women gave birth to stillborns. While in the study group, 13.33% of the pregnant women with SCD and 3.33% with SCT gave birth to stillborns (Figure 2).

In the study group, 5.30% of the neonates born to women with SCA died during the neonatal period. In the control group, 5.33% of neonates died during the neonatal period.

Neonatal outcomes

In the study group, 62.67% were full-term neonates, and in the control group, 69.33% were full-term neonates. But these data were not statistically significant. In the SCT and SCD subgroups, 11.67% and 6.67% of the neonates were born at < 34 weeks of gestation, respectively. The difference between SCT and SCD groups was not significant.

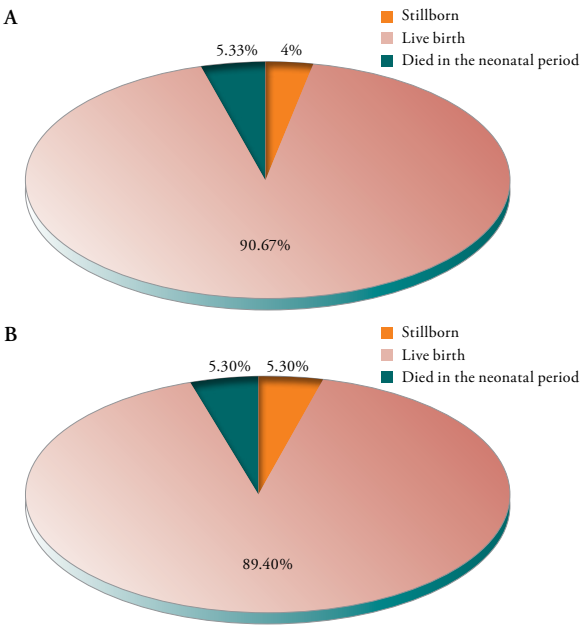

Figure 2. Stillbirths in the (A) Control Group and (B) Study Group

In the study group, of the neonates born to women with SCA, none was large for gestational age. The incidence of small for gestational age was 8% in the control group and 14% in the study group, and the difference was not significant.

In the control group, 6.67% of the neonates were of very low birth weight, whereas in the study group, 9.3% of the neonates were of very low birth weight. The incidence of low birth weight was 73.33% in the SCD subgroup and 53.33% in SCT subgroup. In the study group, 43.97% of the women with SCA gave birth to neonates weighting more than 2.5 kg, whereas it was 48% in the control group. The difference in birth weight values was not statistically significant.

In the control group, only 6.67% of the neonates required NICU admission for comorbidities, but in the study group, 28% required NICU admission, where the difference was statistically significant ($P < .05$). From both the groups, the neonates with sepsis, jaundice, asphyxia, and low birth weight were admitted to the NICU. The average duration of NICU stay was 4.6 days for the neonates from the study group, but these neonates did not have any other comorbidities as with the neonates of the control group. However, in the study group, 40% of the neonates born to women with SCD required NICU admission, whereas 25% of the neonates born to women with SCT required NICU admission; this difference was not statistically significant (Figure 3).

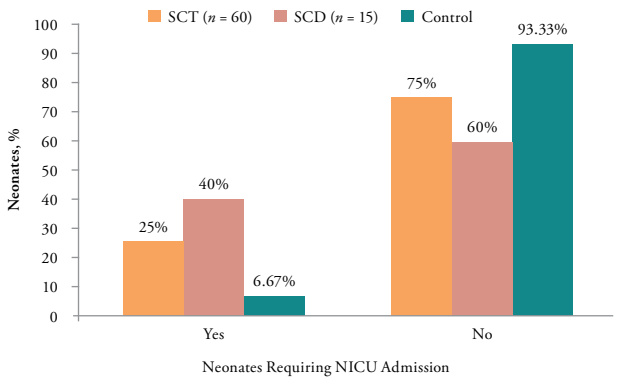

Figure 3. Comparison of Requirement of NICU Admission Between SCD and SCT Subgroups

SCD, sickle cell disease; SCT, sickle cell trait.

Conclusions

- The pregnant women who took proper ANC did not have any complication in the perinatal period, as observed in the control group.
- The neonates who were born to women who received counseling and appropriate ANC were as healthy as those in the control group.
- SCA can complicate pregnancies. Such high-risk pregnancies require proper ANC, as pregnant women with SCA are prone to develop maternal complications such as severe anemia, eclampsia, pre-eclampsia, and oligohydramnios.
- Pregnant women who are at a high risk should be given proper counseling and appropriate care to avoid serious neonatal outcomes. Primary care practitioners must refer such pregnant women to a tertiary care center at the earliest.
- PCV requirement due to uncompensated severe anemia is high during peripartum period in pregnant women with both SCD and SCT. So, intranatal and postnatal services should be provided at facilities where blood can be quickly arranged.

References

1. National Health Mission, State Health Society, Health, and Family Welfare Department, Government of Gujarat. Sickle cell anemia control program. 2012. https://nhm.gujarat.gov.in/. Updated September 5, 2018. Accessed May 25, 2021.
2. Colah RB, et al. Sickle cell disease in tribal populations in India. *Indian J Med Res*. 2015;141(5):509–515.
3. Orkin SH, et al. *Nathan and Oski's Hematology and Oncology of Infancy and Childhood*. 8th ed. New Delhi: Elsevier; 2015:675–700.
4. Schdeva A. *Practical Pediatric Hematology*. New Delhi: Jaypee Brothers Medical Publishers; 2012:85–88.
5. Kliegman RM, et al. *Nelson Textbook of Pediatrics*. 1st South Asia ed. Philadelphia: Elsevier; 2015:2336–2346.
6. Khandale SN, Kedar K. A study of sickle cell trait complications in pregnancy and delivery at tertiary level center. *J Evol Med Dent Sci*. 2015;4(11):1831–1835.
7. Patel J, et al. Screening for the sickle cell gene in Gujarat, India: a village-based model. *J Community Genet*. 2013;4(1):43–47.
8. de Alarcon P, et al, eds. *Neonatal Hematology: Pathogenesis, Diagnosis, and Management of Hematological Problems*. 3rd ed. England: Cambridge University Press; 2021.

9. Pearson HA, et al. Routine screening of umbilical cord blood for sickle cell diseases. *JAMA*. 1974;227(4):420–421.
10. Centers for Disease Control and Prevention. Hemoglobinopathies: current practices for screening, confirmation and follow-up. December 2015. https://www.cdc.gov/ncbddd/sicklecell/documents/nbs_hemoglobinopathy-testing_122015.pdf. Accessed May 25, 2021.
11. Benson JM, Therrell Jr BL. History and current status of newborn screening for hemoglobinopathies. *Semin Perinatol*. 2010;34(2):134–144.
12. Panigrahi S, et al. Neonatal screening of sickle cell anemia: a preliminary report. *Indian J Pediatr*. 2012;79(6):747–750.
13. Gaston MH, et al. Prophylaxis with oral penicillin in children with sickle cell anemia. A randomized trial. *N Engl J Med*. 1986;314(25):1593–1599.
14. Royal College of Obstetricians and Gynaecologists. Management of sickle cell anemia in pregnancy. Green–top Guideline No. 61. July 2011. https://www.rcog.org.uk/globalassets/documents/guidelines/gtg_61.pdf. Accessed May 25, 2021.

Authors' Affiliations

Dr Aarti Mukeshbhai Dalwani, Consultant Pediatrician, Department of Pediatrics and Neonatology, Shalby Hospitals Private Limited, Haridarshan Cross Road, Kathwada Road, Naroda, Ahmedabad 382325; **Dr Sheila Gangadharan Aiyer**, Professor and Head, Department of Pediatrics, Medical College of Baroda, Sir Sayajirao Gaekwad Hospital, Vinoba Bhave Road, Anandpura, Vadodara 390001, Gujarat, India