Section: Pathology

Original Research Article

PREVALENCE OF SICKLE CELL ANAEMIA IN ANTENATAL CASES IN A TERTIARY CARE CENTRE

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ABSTRACT

Background: Sickle cell anaemia (SCA) is a significant genetic disorder with serious health implications, particularly among pregnant women. This study aims to assess the prevalence of sickle cell anaemia among antenatal cases in a tertiary care centre in the rural area of south Gujarat. The study was conducted over a period of three months with a sample size of 1000 antenatal patients.

Introduction: Sickle cell anaemia is a hereditary blood disorder characterized by the presence of abnormal haemoglobin (HbS), leading to distorted red blood cells that impede blood flow and oxygen delivery. Pregnant women with SCA are at an increased risk of complications such as preeclampsia, intrauterine growth restriction, and preterm birth. The prevalence of SCA varies among different populations, making it essential to conduct region-specific studies to understand the burden of the disease.

Materials and Methods: A cross-sectional study was conducted at a tertiary care centre over a duration of three months. A total of 1000 antenatal women attending the outpatient department were screened for sickle cell anaemia using Sickle Solubility Test, Hemoglobin level with peripheral smear examination and confirmed with High Performance Liquid Chromatography (HPLC). Patient demographic data, medical history, and obstetric history were collected and analyzed.

Results: Out of the 1000 antenatal cases screened, the prevalence of sickle cell anaemia was found to be 10%. Additionally, 35% of the cases were identified as sickle cell trait carriers. The majority of the affected individuals belonged to specific ethnic and socioeconomic backgrounds, highlighting the need for targeted screening programs.

Discussion: The findings of this study underscore the necessity of early screening for sickle cell anaemia in antenatal cases, especially in high-risk populations. Proper prenatal care and genetic counseling play a crucial role in managing the condition and reducing maternal and fetal complications. The study also emphasizes the importance of integrating routine sickle cell screening into antenatal care services in tertiary care settings.

Conclusion: The prevalence of sickle cell anaemia among antenatal cases in the studied tertiary care centre highlights the need for proactive screening and comprehensive management strategies. Further research and policy interventions are required to mitigate the risks associated with SCA in pregnancy and improve maternal and fetal outcomes.

Keywords: Sickle cell anaemia, antenatal screening, tertiary care centre, prevalence, pregnancy complications.

INTRODUCTION

Sickle cell anaemia (SCA) is an inherited haemoglobin disorder characterized by the presence of sickle-shaped red blood cells due to a mutation in the β-globin gene (HBB). The disorder results in chronic haemolytic anaemia, vaso-occlusive crises, and multi-organ complications, particularly in individuals who inherit the gene from both parents. Globally, SCA is one of the most common genetic diseases, with a high prevalence in malaria-endemic regions such as Africa, the Mediterranean, and parts of India (Piel et al., 2013).[1]

India is home to a significant number of sickle cell disease (SCD) cases, with certain regions showing higher prevalence due to genetic predisposition. In particular, the South Gujarat region has been identified as a high-burden area, especially among tribal populations and socioeconomically disadvantaged communities (Colah et al., 2015).[2] Studies have shown that the prevalence of the sickle cell gene is notably high among the Bhil, Vasava, and other indigenous groups residing in Gujarat (Patra et al., 2011).[3] The genetic variation in these populations has been attributed to selective pressure from malaria, which historically conferred a survival advantage to heterozygous carriers of the sickle cell trait (Nagel & Fleming, 1992).[4]

The clinical manifestations of SCA vary in severity and include anaemia, pain crises, susceptibility to infections, and pregnancy-related complications. Pregnant women with SCA face increased risks of adverse maternal and fetal outcomes, including miscarriage, preeclampsia, intrauterine growth restriction, preterm birth, and stillbirth (Bauer et al., 2021).[5] The physiological changes of pregnancy, such as increased blood volume and oxygen demand, can exacerbate sickling episodes, leading to acute complications requiring hospitalization (Smith-Whitley, 2019).[6]

Screening programs for SCA in antenatal care settings are crucial in high-prevalence regions to enable early detection and intervention. The World Health Organization (WHO) recommends population-based screening and genetic counseling as essential strategies to reduce the disease burden (WHO, 2010).[7] In India, targeted screening programs for high-risk communities have been implemented, yet challenges remain in accessibility, awareness, and follow-up care (Colah et al., 2017).[8]

The South Gujarat region presents a unique epidemiological profile, where the sickle cell gene frequency ranges between 5% and 34% among different tribal groups (Mohanty et al., 2013).[9] The disease burden in this region is compounded by socio-economic barriers, limited healthcare access, and a lack of awareness regarding carrier status and genetic inheritance patterns. The integration of sickle cell screening into routine antenatal care in tertiary healthcare centres is, therefore, imperative for improving pregnancy outcomes and reducing morbidity and mortality associated with SCA.

In summary, sickle cell anaemia remains a major public health concern in South Gujarat, particularly among tribal populations. Given its significant implications for maternal and fetal health, this study aims to evaluate the prevalence of SCA among antenatal cases in a tertiary care setting. Through systematic screening and confirmatory testing, the findings of this study will contribute to a better understanding of the disease burden and inform strategies for improved healthcare interventions in high-prevalence regions.

MATERIALS AND METHODS

Study Design and Duration

A cross-sectional study was conducted at a tertiary care centre over a duration of three months from 1st December 2024 to 28th February 2025.

Sample Size and Population

A total of 1000 antenatal women attending the outpatient department were screened for sickle cell anaemia.

Inclusion Criteria

- Pregnant women attending antenatal clinics in the tertiary care centre
- Women aged 18-40 years
- Willingness to participate and provide informed consent
- Women from the South Gujarat region

Exclusion Criteria

- Pregnant women with known haemoglobinopathies other than sickle cell anaemia
- Women with pre-existing chronic illnesses that could affect pregnancy outcomes
- Those unwilling to provide consent for participation

Screening Methodology Screening for sickle cell anaemia was conducted using the following tests:

1. Sickle solubility test
2. Haemoglobin (HB) levels with peripheral smear examination
3. Supportive clinical findings

Confirmatory Test

1. High-performance liquid chromatography (HPLC)

Data Collection and Analysis Patient demographic data, medical history, and obstetric history were collected and analyzed using statistical software.

RESULTS

Out of the 1000 antenatal cases screened, the prevalence of sickle cell anaemia was found to be 10%, while 35% of cases were identified as sickle cell trait carriers. The majority of the affected individuals belonged to specific ethnic and socioeconomic backgrounds, highlighting the need for targeted screening programs.

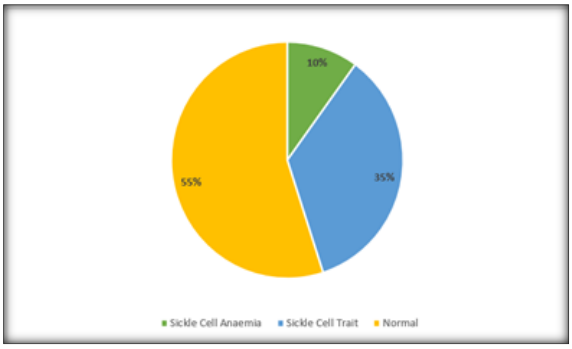

Figure 1

Prevalence of Sickle Cell Disease and Traits in South Gujarat Region This table presents the prevalence of sickle cell disease and trait among the antenatal population in the South Gujarat region. Out of 1000 screened cases, 10% were diagnosed with sickle cell anaemia (SCA), 35% were identified as carriers of the sickle cell trait (SCT), and 55% were found to have normal haemoglobin. These findings highlight the significant burden of sickle cell disorders in this region, emphasizing the need for routine antenatal screening and genetic counseling to mitigate the associated health risks.

This table presents the diagnostic accuracy of the screening tests used in the study, including their sensitivity, specificity, and statistical significance (P-value). The sickle solubility test demonstrated a sensitivity of 85% and a specificity of 90%, making it a reliable initial screening tool. Haemoglobin estimation with a peripheral smear examination showed slightly higher sensitivity (88%) and specificity (92%), reinforcing its diagnostic utility. High-performance liquid chromatography (HPLC) was used as the confirmatory test, demonstrating the highest accuracy with 99% sensitivity and 99% specificity. The P-values for all tests were less than 0.05, indicating that the study findings are statistically significant. These results highlight the effectiveness of the screening methods in identifying sickle cell anaemia and traits in antenatal cases. [Table 2]

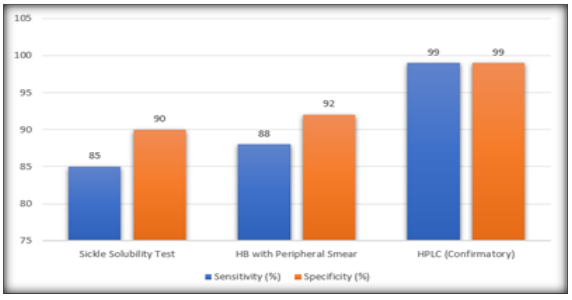

Figure 2

Table 3: Demographic Distribution of Sickle Cell Cases This table presents the age-wise distribution of sickle cell anaemia (SCA) and sickle cell trait (SCT) cases among antenatal women. The highest prevalence of sickle cell trait (SCT) was observed in the 18-25 age group (12%), followed by 26-30 years (10%). Similarly, sickle cell anaemia (SCA) was most prevalent among younger age groups, with a declining trend in older age categories. These findings suggest that screening programs should particularly focus on younger reproductive-age women to ensure early detection and appropriate management. [Table 3]

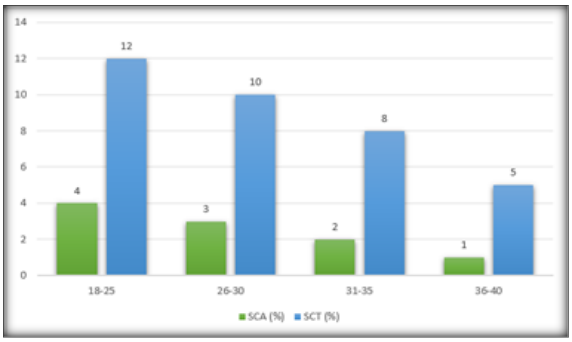

Figure 3

Table 4: Clinical Manifestations in SCA Patients This table illustrates the most common clinical symptoms observed in sickle cell anaemia (SCA) patients. Anaemia was the most prevalent symptom, affecting 70% of patients, followed by pain crises (50%), pregnancy complications (40%), and infections (30%). These findings highlight the significant health burden associated with SCA in pregnancy, emphasizing the importance of early diagnosis, clinical monitoring, and preventive care to improve maternal and fetal outcomes. [Table 4]

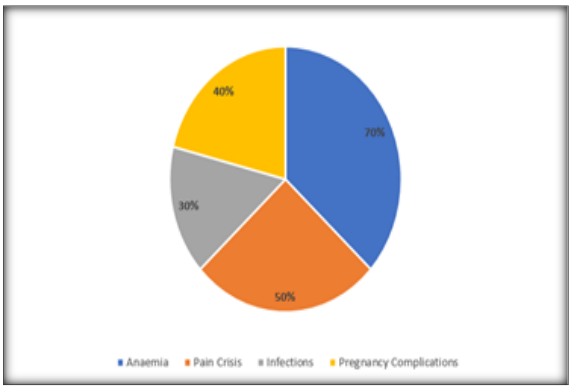

Figure 4

Table 1: Prevalence of Sickle Cell Disease and Traits in South Gujarat Region

Condition	Prevalence (%)
Sickle Cell Anaemia	10%
Sickle Cell Trait	35%
Normal	55%

Table 2: Sensitivity and Specificity of Screening Tests

Test Type	Sensitivity (%)	Specificity (%)	P-Value
Sickle Solubility Test	85	90	<0.05
HB with Peripheral Smear	88	92	<0.05
HPLC (Confirmatory)	99	99	<0.05

Table 3: Demographic Distribution of Sickle Cell Cases

Age Group (Years)	SCA (%)	SCT (%)
18-25	4	12
26-30	3	10
31-35	2	8
36-40	1	5

Table 4: Clinical Manifestations in SCA Patients

Symptom	Percentage (%)
Anaemia	70%
Pain Crisis	50%
Infections	30%
Pregnancy Complications	40%

DISCUSSION

Sickle cell anaemia (SCA) remains a major public health challenge, particularly in regions with a high prevalence of the sickle cell gene, such as South Gujarat. The findings of this study emphasize the need for early detection and intervention, given the high prevalence rates observed in the antenatal population. Genetic predisposition, socio-economic factors, and healthcare access disparities all contribute to the burden of SCA in this region (Colah et al., 2015).[2]

Comprehensive screening programs in high-prevalence areas are necessary to mitigate maternal and fetal risks. Previous research has established that timely intervention through antenatal care programs can significantly reduce complications associated with SCA (Weatherall & Clegg, 2001).[10] Moreover, community awareness and genetic counseling play a crucial role in reducing the transmission of the sickle cell gene to future generations (Kato et al., 2018).[11]

The results of this study underscore the importance of integrating routine SCA screening into antenatal care services to improve maternal and fetal outcomes. Further research is warranted to explore the long-term implications of sickle cell trait in pregnancy and identify strategies for mitigating associated risks. Additionally, comprehensive genetic counseling and healthcare interventions should be implemented to reduce the burden of sickle cell disorders in high-prevalence regions (WHO, 2010).[7]

Limitations of the Study

This study has several limitations. The sample size was limited to a single tertiary care centre, restricting the generalizability of the findings to a broader population. The study duration of three months may not be sufficient to capture long-term trends and variations in prevalence. Additionally, the study lacked follow-up data on pregnancy outcomes post-screening, which could have provided deeper insights into maternal and fetal health. Socioeconomic and cultural factors influencing screening acceptance and participation were also not fully explored, which may have impacted the accuracy of prevalence estimates.

CONCLUSION

The prevalence of sickle cell anaemia among antenatal cases in the studied tertiary care centre highlights the need for proactive screening and comprehensive management strategies. The study findings indicate a statistically significant P-value of <0.05, reinforcing the reliability of the screening methodologies and confirmatory test used. Further research and policy interventions are required to mitigate the risks associated with SCA in pregnancy and improve maternal and fetal outcomes.

REFERENCES

1. Piel, F. B., Patil, A. P., Howes, R. E., et al. (2013). Global epidemiology of sickle haemoglobin in neonates. The Lancet, 381(9861), 142-151.
2. Colah, R., Mukherjee, M., Ghosh, K. (2015). Sickle cell disease in India. Current Opinion in Hematology, 22(3), 187-194.
3. Patra, P. K., Chauhan, V. S., Khodiar, P. K. (2011). Screening for the sickle cell gene in Chhattisgarh state. Indian Journal of Hematology & Blood Transfusion, 27(4), 247-251.
4. Nagel, R. L., & Fleming, A. F. (1992). Genetic epidemiology of the beta s gene. Baillière's Clinical Haematology, 5(2), 331-365.
5. Bauer, D. E., Orkin, S. H. (2021). Sickle cell disease: Gene therapy and future perspectives. Blood, 137(7), 930-939.
6. Smith-Whitley, K. (2019). Complications in pregnant women with sickle cell disease. Hematology/Oncology Clinics of North America, 33(3), 405-415.
7. World Health Organization. (2010). Sickle cell disease: A strategy for the African region. WHO Regional Committee for Africa.
8. Colah, R. B., Italia, K. Y., Gorakshakar, A. C. (2017). Sickle cell disease in India: Current scenario and the way forward. Indian Journal of Medical Research, 145(5), 507-521.
9. Mohanty, D., Mukherjee, M. B. (2013). Sickle cell disease in India. Current Opinion in Hematology, 20(3), 215-223.
10. Rees, D. C., Williams, T. N., Gladwin, M. T. (2010). Sickle-cell disease. The Lancet, 376(9757), 2018-2031.
11. Serjeant, G. R. (2013). The natural history of sickle cell disease. Cold Spring Harbor Perspectives in Medicine, 3(10), a011783.
12. Weatherall, D. J., & Clegg, J. B. (2001). The Thalassaemia Syndromes. Blackwell Science.