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Minimizing the risk of acquisition of infections among pregnant women with sickle cell disease

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Abstract:

Pregnant women with sickle cell disease (SCD) have been acknowledged as a high-risk pregnancy owing to the reported high incidences of complications, including death, both among the women and the fetus. The objectives of the current article are to identify various infections to which pregnant women with SCD are prone to acquire, enlist different challenges due to which pregnant women with SCD are at high risk to acquire infections, and propose infection prevention measures at different levels to reduce the overall burden. Pregnant women with SCD are at high risk of acquiring infections from multiple microorganisms. The high rates of infections among pregnant women with SCD are predominantly because of the presence of multiple barriers and challenges. Acknowledging the fetomaternal complications among pregnant women with SCD, high risks of acquiring infection, and the presence of multiple barriers, there is an urgent need to implement measures at different levels to mitigate the impact of these barriers. To conclude, pregnant women with SCD are prone to multiple risks, including acquiring a wide range of infections. The need of the hour is to adopt a multipronged approach to minimize the risk of acquisition of infections, thereby improving fetomaternal outcomes.

Keywords:

Infections, pregnancy, pregnant women, sickle cell disease, streptococcus

Introduction

Pregnant women with sickle cell disease (SCD) have been acknowledged as a high-risk pregnancy owing to the reported high incidences of complications, including death, both among the women and the fetus.[1-3] This was reported in a meta-analysis, which conclusively revealed that pregnant women with SCD had high rates of obstetric complications, in contrast to pregnant women without SCD.[1] It was also reported that these women had more episodes of vaso-occlusive events, severe anemia, and infections during the antenatal period, which remarkably impaired the quality of life.[2] The results of a nationwide cohort study done in France highlighted the high incidence of preterm births and adverse neonatal outcomes in pregnant women with SCD than women without the disease.[3] Another secondary study reported the presence of intrauterine growth restriction, low birth weight, stillbirth, and perinatal mortality among pregnant women with SCD.[1] The objectives of the current article are to identify various infections to which pregnant women with SCD are prone to acquire, enlist different challenges due to which pregnant women with SCD are at high risk to acquire infections, and propose

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infection prevention measures at different levels to reduce the overall burden.

Pregnancy with Sickle Cell Disease and Infections

Pregnant women with SCD are at high risk of acquiring infections from multiple microorganisms [Figure 1], such as Streptococcus pneumoniae, Haemophilus influenzae, Salmonella typhi, etc.[4] The results of a systematic review revealed that these pregnant women are prone for urinary tract infections than non-SCD women.[1] Pneumonia and other pulmonary complications were reported among pregnant women in a systematic review, with no major difference being reported across different serotypes.[5] In a study done among 28 pregnant women with SCD, respiratory viral infections resulted in serious complications and raised maternal and fetal mortality rates.[6] In addition, systemic bloodstream infections originating from bacterial sources have also been reported in such high-risk pregnancies.[4] This high predisposition to infections is primarily due to the frequent vaso-occlusive episodes in the spleen resulting in infarction and progressive loss of organ functions (namely, reduced ability to clear encapsulated bacteria).[6]

From a biophysical angle, vaso-occlusive crisis in pregnant women with SCD is determined by changes in blood rheology and microvascular flow dynamics.[7] Owing to the polymerization of deoxygenated hemoglobin S, changes in the mechanical properties of erythrocytes have been observed, which augment cellular rigidity and blood viscosity, and eventually, laminar flow in small vessels is impaired.[8] These physics-driven alterations in perfusion of smaller vessels significantly result in dysfunction of the spleen and derangements in immune clearance, thereby enhancing susceptibility to infections.[7,8] Recurrent sickling also results in infarction of different organs, and makes these organs prone for bacterial invasion and impairment of immune responses.[9] In addition, due to the ongoing hemolysis, a rise in the levels of free hemoglobin and inflammatory mediators has been reported, which can interfere with the response of the host to the infection.[4] Finally, we must not ignore that pregnancy itself alters maternal immunity, and when this is couple with immune defects resulting because of SCD, the risk of acquiring bacterial infection becomes almost 2.48 times among pregnant women.[10]

Identified Barriers

The high rates of infections among pregnant women with SCD are predominantly because of the presence of multiple barriers and challenges.[11-16] This is mainly due to the limited access to specialized antenatal care services, augmenting the possibilities of undetected infections and complications among them.[11] Even if present, due to the low health literacy and lack of awareness about the condition and associated complications, many women fail to receive timely care and present with poor fetomaternal outcomes, as highlighted in a 5-year retrospective study done in a tertiary hospital in Nigeria.[12] The role of health inequity was envisaged among marginalized population groups, who have limited knowledge about preventive care, screening, and the importance of early healthcare seeking.[13] The lack of knowledge about different aspects of SCD, including infection prevention and management among healthcare professionals can result in delivery of suboptimal care and poor outcomes.[14]

The presence of socioeconomic and structural factors (such as poverty, lack of health infrastructure, disconnect between departments) and logistic concerns (such as lack of transport, involved costs, etc.) has been reported for the poor obstetric management of pregnant women

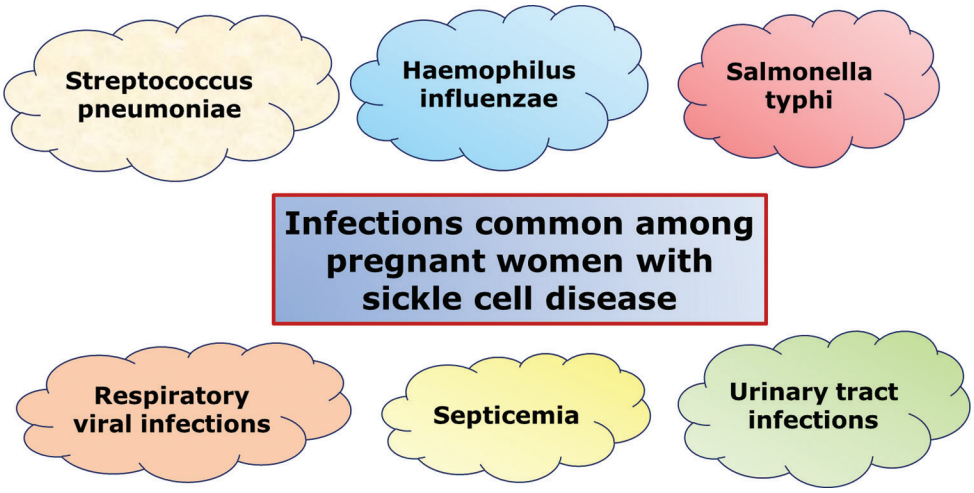

Figure 1: Common infections among pregnant women with sickle cell disease

with SCD, especially in low-income nations.[15] We must not undermine the presence of social stigma linked with SCD, which can discourage pregnant women from seeking timely care, making them prone to infections.[13] Moreover, frequent pain episodes, the chronic nature of the disease, and treatment fatigue negatively affect treatment adherence and follow-up, allowing infections to progress undetected among pregnant women.[16] Further, due to the lack of high-quality studies on infection prevention specifically among pregnant women with SCD, we have not been able to formulate evidence-based recommendations and practice for optimal management.[11]

Infection Prevention Measures

Acknowledging the fetomaternal complications among pregnant women with SCD, high risks of acquiring infection, and the presence of multiple barriers, there is an urgent need to implement measures at different levels to mitigate the impact of these barriers [Table 1].[1,3,10,14,17-27] At the individual level, these pregnant women must receive existing antenatal vaccinations and additional vaccines (namely pneumococcal and meningococcal), if not received, as this significantly reduces susceptibility to develop serious infections.[10,17] This must go along with frequent screening for common infections, which will minimize the risk of progression to severe forms and complications.[1] Strategies aimed at educating women on identifying early symptoms of infection and preventive measures (such as clean water use, handwashing, sanitation, etc.), can empower then to mitigate the risk of infection or timely avail healthcare services during pregnancy, as highlighted in a community-based pilot study in Nigeria.[18]

Table 1: Infection prevention measures

Level	Proposed measures
Individual level	Receive existing antenatal vaccinations and additional pneumococcal and meningococcal vaccines (if not received)
	Frequent screening for common infections
	Education on early symptoms of infection
	Use of clean water, handwashing, and sanitation practices
	Genetic counselling and health optimization before pregnancy
	Adequate intake of micronutrients (folic acid and other vitamins)
Health system level	Regular screening for common infections with appropriate treatment
	Strengthening antenatal care services and ensuring availability of specialists
	Ensure access to clean water, sanitation, and hygiene services
	Ensure access to immunization services against common infections
	Training healthcare professionals in infection recognition and early management
	Ensure access to reliable laboratory diagnostics
	Provision of infection prevention kits in antenatal settings
Community level	Targeted education programmes on SCD and newborn screening
	Involvement of community members in awareness campaigns
	Integration of maternal health education into routine antenatal outreach services
	Community engagement to overcome stigma associated with SCD
Policy level	Implementation of global recommendations on management of SCD in pregnancy
	Screening for infections and provision of case-specific care through policy measures
	Ensure reliable access to laboratory diagnostics and infection prevention kits

SCD=Sickle cell disease

The right approach at the individual level would be to prepare before pregnancy through genetic counselling and optimization of health, which can reduce the risk of infections and complications once women become pregnant.[19] Moreover, by ensuring adequate intake of micronutrients, such as folic acid and other vitamins, immune function and overall health can be improved, and it can aid in infection resistance.[10] At the health system level, the primary approach would be to initiate regular screening of common infections and supplement it with appropriate treatment.[1,3] This should be supplemented with strengthening of antenatal care services, including ensuring availability of specialists, to increase the probability of early identification and management of infections in SCD pregnancies, as encouraging outcomes were reported in a case–control study done in Bahrain.[20]

Further, healthcare systems must ensure access to clean water, sanitation and hygiene to minimize exposure to pathogens, as advocated in heterogeneous settings.[18,21] Health systems should ensure access to immunization services against all common infections, as vaccination is a key strategy to minimize the risk of acquisition of infection among high-risk pregnant women.[10,17] In addition, healthcare professionals should be trained in infection recognition and early management of severe maternal infections through proper hygiene practices.[14,22,23] At the community level, targeted education programs to improve knowledge about SCD and newborn screening can improve their behavior to seek preventive care and reduce risk of infections.[18] The results from a multicentric study done among tribal Indian populations revealed that a significant improvement in the level of awareness about different aspects of SCD was reported, primarily due to the involvement of community members in campaigns.[24]

In a quasi-experimental study done in Tanzania, maternal health education activities were integrated into routine

antenatal outreach services, and this initiative brought about an improvement in understanding of SCD and better uptake of diagnosis and preventive measures.[25] In a cross-sectional study done in Oman, special emphasis was given to engage community members to overcome the stigma associated with SCD, and this brought about an improvement in the utilization of preventive services, which could reduce the risk of infection.[26] At the policy level, nations must implement global recommendations on the management of SCD in pregnancy, including screening for infections and provision of case-specific care.[27] Policies must ensure reliable access to laboratory diagnostics and infection prevention kits in antenatal settings for maximum benefit [Table 1].[27]

Conclusion

Pregnant women with SCD are prone to multiple risks, including acquiring a wide range of infections. The need of the hour is to adopt a multipronged approach to minimize the risk of acquisition of infections, thereby improve fetomaternal outcomes.

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Conflicts of interest
There are no conflicts of interest.

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