

Nutrition in Sickle Cell Disease

A multifactorial phenomenon



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Recent reviews by American researchers,¹ highlighting under nutrition as a critical feature of sickle cell disease (SCD), challenges experts in the field of nutrition to pay attention to the nutritional needs of this patient population. With the emphasis on nutrition, campaigns such as 'Nutrition and Hydration Week', compels a strong case that this evidence should not be ignored. An article published in the *Journal of Human Nutrition and Dietetics*,² draws attention to the importance of good nutrition in preventing and reducing the incidence of malnutrition. The health and social care costs associated with malnutrition are estimated to amount to at least £13 billion annually,³ escalating the financial burden on NHS resources.

SCD is not only the fastest growing genetic blood disorder;⁴ its management is complex and multifactorial. Failing to acknowledge the mass of factors which impacts the health and psychosocial wellbeing of these patients would seriously hamper the accurate assessment of the nutritional risks of these patients across their lifespan.

Over the years, nutrition research in SCD has clearly demonstrated the impact the pathophysiology has on the various nutritional elements essential for good health, such as boosting immunity, repair and growth.¹ A clear understanding of what the pathophysiology entails is imperative to gauging the full impact it has on the nutritional status of the individual. Next follows a brief overview of the main pathological features and processes, which characterises the condition.

General features

The primary cause of the clinical symptomatology of sickle cell disease, which leads to the debilitating microvascular occlusions, haemolytic anaemia and chronic inflammation characteristics of this disease,⁵ is the intracellular polymerisation of sickle haemoglobin (HbS) that occurs when sickle erythrocytes are partially deoxygenated under the hypoxic conditions.⁶

The clinical manifestations of the disease are quite variable and complications affect various organs and systems, including skeletal, genito-urinary, gastrointestinal, spleen, hepato-biliary, cardio-pulmonary and central nervous.⁷

Haemolysis and vaso-occlusion are the two main clinical processes. **Haemolysis** refers to the rapid breakdown of red cells which is present as a chronic anaemia. In SCD the red cells have a shortened lifespan – 16-20 days – in contrast to a lifespan of 120 days in normal red cells.⁸

Vaso-occlusion is caused by the blockage of small vessels, by sickle shaped red blood cells, resulting in tissue infarction and painful crisis; this forms the most common clinical manifestation of SCD. Large vessel damage, responsible for complications such as pulmonary hypertension and stroke is caused by repeated endothelial damage by adherent sickle cells, complicated by vasoconstriction and nitric oxide (endogenous vasodilator) deficiency.⁸

Hypoxia, acidosis, dehydration, infection, extreme fatigue, trauma, temperature changes (sudden), stress/anxiety and increased physical/physiological demand (pregnancy, physical exercise) are factors which precipitate a sickle cell crisis.⁹

The appropriate and effective assessment of the nutritional risks of SCD patients is determined by how well we factor in all the relevant components which influence the nutritional needs of this patient group.

Figure 1 demonstrates the four main components to consider when managing nutrition in SCD, which includes the following:

1. Nutritional considerations (infection, dehydration, increased nutritional requirements, frailty and gastrointestinal symptoms)
2. Medical considerations (painful crisis, analgesia, disease modifying drugs, iron chelation)
3. The wider determinants of health
4. Psychosocial considerations.

Nutritional considerations

Infection

From early childhood the spleen of people with sickle cell disease does not work optimally (often non-functioning due to splenic sequestration or splenectomy), therefore they do not develop good immunity and are prone to getting infections, especially pneumococcal infections. It is recommended that children from the age of three months take penicillin twice a day to help reduce the rate of pneumococcal infections, and this should be continued into adulthood.⁹

Dehydration

One of the most common causes of sickle cell crisis is an insufficient amount of water in the body (dehydration). As a result, the blood becomes thicker and sickled shaped red blood cells are more likely to stick together and cause a blockage in the blood circulation. To help combat this risk factor, it is important for an adult to drink at least **3–4 Litres** of water daily; this is apart from the water contained in the food they eat.⁹

Increased nutritional requirements

Features such as delayed growth, increased resting energy expenditure (REE), poor immunity, high protein turnover, low BMI and poor exercise tolerance, compelled by the pathophysiological processes, contribute to the increased nutritional requirements and subsequent high risk of malnutrition.¹ There are exceptions to the rule albeit a small percentage of patients.

Frailty

Frailty is not often associated with SCD but this is debatable. Many patients present with symptoms of frailty (an area requiring more research), which include the following: weight loss, low mood, isolation, immobility and risk of falls¹⁰ especially immediately before, during and post painful crisis when pain levels for most patients, prevent them from performing their activities of daily living. For some patients with chronic pain this may be a daily occurrence, adding to their isolation and low mood, which can often affect their appetite and oral intake, in turn exacerbating the disability associated with the condition.

Gastrointestinal intolerance

The medical management of SCD, used to manage acute painful crisis, which includes the disease modifying treatment regimens and the opiate analgesia, has many notable gastrointestinal side effects, such as constipation, diarrhoea, nausea, vomiting, reflux, etc.¹¹ This is another area that is under recognised but may have serious nutritional implications for the patient with SCD. More research is needed to expedite the nutritional needs associated with these gastrointestinal side-effects.

Medical considerations

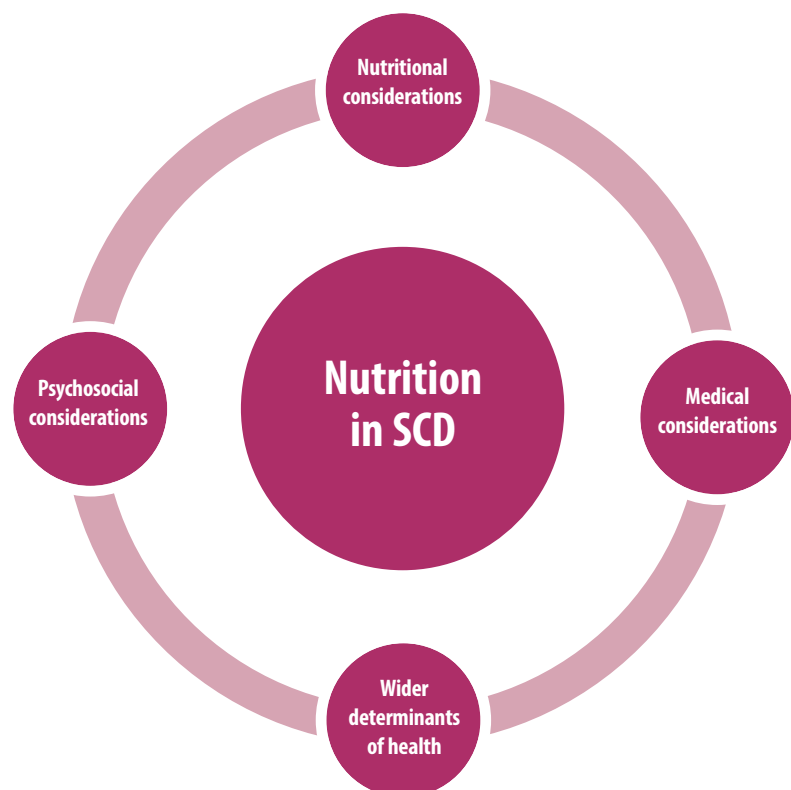
Painful crisis

Painful crisis, the main clinical feature of SCD, resulting from ischaemic necrosis of bone marrow and the subsequent inflammatory reaction, is the usual clinical problem requiring admission to hospital. Patients present with variable degrees of bone pain, which may affect any part of the skeleton but particularly the long bones of the legs, arms, back and chest.¹¹

Analgesia

Patients with acute presentations of painful crisis usually require parenteral opiate analgesia to control their pain, which should be given as soon as possible and on a regular basis.¹¹ This places many patients at risk of developing the gastrointestinal side-effects common to opiate analgesia, which if unchecked can have serious nutritional repercussions for the patients.

Figure 1: Four Main Components to Managing Nutrition in SCD



Treatment modalities

Hydroxyurea

Hydroxyurea, a ribonucleotide reductase inhibitor, requires close monitoring of the patient due to its multiple side effects, even though it has been shown to be effective in both paediatric and adult patients. It has been used to reduce the incidence of painful crises and acute chest syndrome, as well as the need for transfusion in those with more severe disease.¹²

Transfusion therapy

Blood transfusions, will clinically improve the microvascular perfusion of tissues and by raising the oxygen carrying capacity of blood and decrease the proportion of sickle red cells.¹³ An inevitable consequence of continued blood transfusion (250 mg iron/unit of red cells) is iron overload (an accumulation of iron in the tissues of organs like the heart and liver) requiring iron chelation drugs which have many gastrointestinal side-effects, again, impacting the nutritional risk of this patient population.

Iron chelation

Iron chelation therapy is prescribed for those on chronic blood transfusion programmes, which may be given parenterally (Desferal) or orally (Ferriprox and Exjade). The side effects, especially of the oral therapy (Ferriprox and Exjade), include neutropenia, renal and hepatic impairment, gastrointestinal disturbances/upset, diarrhoea and proteinuria.¹¹

Wider determinants of health

Improving the quality of life (QOL) and life expectancy of the SCD patients cannot be achieved in isolation and there are a number of other factors which contribute to the health of this patient group. Dahlgren and Whitehead's 'wider determinants of health'¹⁴ identifies some of the key issues which need consideration when trying to improve the QOL and life expectancy of lower socio-economic communities – age, ethnicity, poverty, housing, employment, to mention but a few. Therefore, the aim shouldn't simply be about helping patients to live longer – this patient group can have a reduced life expectancy – it is about living longer and well. Incorporated in the 'public health outcomes framework' (Healthy lives Healthy People: Improving Outcomes and Supporting

Transparency)¹⁵ are the four domains: Improving the wider determinants of health, Health improvement, Health protection and Healthcare public health and preventing premature mortality. It acknowledges the factors mentioned by Dahlgren and Whitehead and others, which have a direct bearing on the health and health behaviour of SCD patients. The 'outcomes' provide valuable directives to focus our energies to improve the QOL and life expectancy. However, for this to materialise, we need to have the backing of government agencies to facilitate and recognise the limitations of the disease.¹⁶

Psychosocial considerations

How we perceive ourselves is greatly influenced by our own perceptions and experiences, the environments we live in, and other people's opinions, which cumulatively compounds our life views when we also suffer from a complex, often debilitating, incurable long-term health condition. When the chronic health condition negatively affects one's QOL and invariably one's life expectancy, this adds injury to insult. All these dynamics further perplexes the interplay between our psyche and our social environment, in addition to finding strategies to deal with a wide array of perceived obstacles, prejudice and stigma (both internal and external) which backdrops the condition. This is the reality of many SCD patients and augments the complexity of effectively managing the long-term health condition. Notwithstanding, SCD also often affects the psychological wellbeing of the sufferer,¹⁷ with the most common psychological presentations for SCD being depression and anxiety.

Conclusion

The multifactorial nature of SCD deserves recognition and careful consideration on both a policy and developmental level. Currently, there are limited sickle cell specific nutritional services, guidelines and resources available in the UK, for both healthcare professionals and patients, and this has to change. Therefore, standards of care to effectively manage SCD must address the multifactorial nature of the long-term condition which contributes to the nutritional risks of this patient population.

Supporting those with sickle cell disease

Sickle Cell Society - <http://sicklecellsociety.org>

The Sickle Society is a registered charity which was set up by a group of patients, parents and health professionals who were concerned about the lack of understanding and treatment for sufferers of sickle cell disorders. Claudine has recently written a guest post for the Society, visit: <http://sicklecellsociety.org/nutrition-in-sickle-cell-underused-and-under-recognised/>

The Homerton Hope - www.homerton.nhs.uk/about-us/homerton-hope-charity

Homerton Hope is Homerton Hospital's Charitable Fund, one of their goals on their 'wish list' is to generate funding for the Sickle Cell unit to offer drop-in alternative therapy sessions like reflexology, acupuncture and massage for patients, along with day trips for the elderly patients.

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