Enhancing the care of patients with sickle cell disease

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Abstract
When typically round red blood cells intermittently elongate and become lodged in the body’s microcirculation, this can result in painful vaso-occlusive crises, often referred to as ‘sickle cell crises’. The sickling and unsickling process can result in acute pain, chronic anaemia, ischaemic injury and multiple organ damage. One of the main concerns raised by patients with sickle cell disease is the lack of knowledge and understanding of their condition among healthcare professionals in acute care settings. Therefore, this article aims to enhance nurses’ understanding of sickle cell disease and the effective management of painful vaso-occlusive crises. While sickle cell disease was traditionally perceived to only occur in people of black African or African-Caribbean ethnic origin, this article seeks to challenge this belief and reconsider sickle cell as a public health concern for all.

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Sickle cell disease is the most common serious and life-limiting genetic disorder in the UK (East Midlands Specialist Commissioning Group 2011). It is estimated to affect around 15,000 people in England, of which 10,000 individuals are located in London (Isokariari 2016). The prevalence of sickle cell disease more than doubled between 2011 and 2016, and the number of people with the condition continues to rise in the UK (Isokariari 2016).

Sickle cell disease occurs predominantly in individuals of black African or African-Caribbean descent, although it is also prevalent in the Eastern Mediterranean, Middle East, India, and South and Central America (Sickle Cell Society 2018). The common factor is a high prevalence of malaria in the area, or migration from a malarial area, because sickle cell carriers have partial protection from malaria, which is a survival advantage.

It is essential that all healthcare professionals develop their understanding of genetics, particularly the knowledge that sickle cell disease could potentially affect anyone (Kirk and Tonkin 2009). Despite sickle cell disease being among the most common genetic conditions worldwide, public awareness of the condition remains relatively low (Dyson and Atkin 2011). This article aims to raise awareness of sickle cell disease and its management among nurses, particularly those practising in acute care settings.

Pathophysiology of sickle cell disease
Haemoglobin is the oxygen-carrying component in red blood cells and it also has a role in maintaining the shape of red blood cells. It comprises four ‘globin’ protein chains, each wrapped around an iron-containing ‘haem’ molecule (Tortora and Derrickson 2017). Newborn babies have a form of haemoglobin known as fetal haemoglobin, which is largely replaced by adult haemoglobin in the first year of life (Sickle Cell Society 2018). In people with sickle cell disease, haemoglobin molecules can spontaneously form long rigid polymers when they are in their deoxygenated state (Herrick 1924). This causes the red blood cells...
to lengthen and become sickle-shaped in appearance, as part of what is known as a sickling process (Frenette and Atweh 2007). These sickle-shaped red blood cells can become lodged within the blood vessels of the body’s microcirculation, causing blockages (vaso-occlusion) and accumulation of red blood cells. This is known as a vaso-occlusive crisis, also referred to as a sickle cell crisis or an acute painful episode, and causes acute pain and ischaemic injury to the organs affected (Manwani and Frenette 2013).

Normally, the lifespan of a healthy red blood cell is 110-120 days (Tortora and Derrickson 2017). However, because of the effects of the sickling and unsickling process (where the red blood cells naturally regain their shape), the lifespan of the red blood cell can decrease to 5-11 days, known as accelerated haemolysis (De 2008). Accelerated haemolysis often leads to haemolytic anaemia (De 2008).

There are few specific interventions available for sickle cell disease, aside from palliative care. Treatment plans typically involve opioid-based analgesics to relieve vaso-occlusive pain, and blood transfusions to increase the delivery of oxygen to the tissues and prevent complications. In limited cases, bone marrow transplantation has been successful in curing sickle cell disease (Bolaños-Meade et al 2012).

Genetics and screening

The term sickle cell disease refers to a group of conditions that affect the red blood cells. Sickle cell disease is a haemoglobinopathy, which is an umbrella term used to describe inherited disorders that are usually autosomal recessive (two copies of an abnormal gene must be present for the disease to develop) (Norfolk 2013). Some haemoglobinopathies affect the quality and structure of haemoglobin, such as sickle cell disease, while other haemoglobinopathies affect the quantity of haemoglobin present, such as thalassaemias. Haemoglobinopathies appear to have developed as a by-product protection mechanism against falciparum malaria, originating in Sub-Saharan Africa, the Arabian Peninsula and the Indian subcontinent (Amale et al 2013).

The genetic mutation that causes sickle cell disease is the substitution of one amino acid, glutamic acid, for another, valine, in the beta haemoglobin chain (El Khatib and Hayek 2016). This change causes the production of sickle haemoglobin (haemoglobin S or HbS), which can aggregate in the blood vessels. One severe form of sickle cell disease is sickle cell anaemia (HbSS), which occurs if an individual inherits two sickle cell genes, one from each parent. Other forms of sickle cell disease may occur if the sickle cell gene is inherited from one parent and another gene for abnormal haemoglobin or beta thalassaemia is inherited from the other parent, for example sickle cell-β-thalassaemia C (HbSC) disease or sickle cell-beta thalassaemia. If an individual has inherited the sickle cell gene from one parent and the gene for normal haemoglobin from the other parent, they will have the sickle cell trait; they will not usually have symptoms of sickle cell disease themselves, but could pass on the sickle cell gene to their children.

Several countries have developed comprehensive newborn and antenatal screening programmes to identify those with the sickle cell trait and to ensure that all patients with sickle cell disease receive optimal healthcare (Streetly et al 2008). In the UK, screening for sickle cell disease is delivered through the NHS Sickle Cell and Thalassaemia screening programme and the linked Newborn Blood Spot screening programme. Screening can also be undertaken opportunistically in primary care services, or may be required in an emergency before surgery (Sickle Cell Society 2018).

It is also important to inform women of the increased risk of vaso-occlusive crisis occurring within the placental bed when giving birth, which presents a risk of sickle cell disease to the fetus during birth and a serious risk of infection after birth for the mother and baby (Atkin et al 2008). Identifying those at risk of sickle cell disease enables early treatment to be initiated, such as immunisations and prophylactic antibiotics, which have been directly linked to improved survival rates (National Institute for Health and Care Excellence (NICE) 2016).

Clinical manifestations and complications

Sickle cell disease can vary in severity, signs and symptoms (Frenette and Atweh 2007), which means that its clinical manifestations can be diverse. Box 1 outlines the main features and severe complications of sickle cell disease (Shiel 2018, Sickle Cell Society 2018).

More than 90% of hospital admissions of people with sickle cell disease are because of painful vaso-occlusive crises (Anionwu and Atkin 2001, Sickle Cell Society 2018). Every vaso-occlusive crisis can be painful, although the intensity and duration of these crises can vary significantly. Each crisis should be considered life-threatening (Manwani and Frenette 2013), and delays in instigating treatment could lead to exacerbation of symptoms and severe complications, such as acute chest syndrome (Sickle Cell and Thalassaemia All-Party Parliamentary Group (SCTAPPG) 2018). Therefore, hospitals need...

Acute chest syndrome is one of the most severe complications of sickle cell disease (NICE 2014). It is characterised by fever and/or respiratory symptoms, new pulmonary infiltrate on chest X-ray, and pulmonary artery hypertension (Manwani and Frenette 2013). Nurses should monitor and record the patient’s oxygen saturation levels (Dougherty and Lister 2015), since low oxygen saturation levels could be an early sign of acute chest syndrome (NICE 2014). NICE (2014) guidance recommends commencing supplementary oxygen therapy if the patient’s capillary oxygen saturations fall below 95%. If acute chest syndrome is suspected, it is essential to provide timely referral to respiratory specialists, intensivists and apheresis nurses who can administer blood transfusions (Sickle Cell Society 2018).

Nurses in acute care settings also need to be vigilant in recognising individuals presenting with symptoms that may be related to anaemia, such as frequent headaches, dizziness, pallor, lethargy, shortness of breath, leg cramps, insomnia, jaundice or koilonychia (nails that curve inwards and become spoon-like in appearance) (Tortora and Derrickson 2017). A timely full blood count screen for anaemia is recommended as part of the acute care admission process and will guide subsequent management (Sickle Cell Society 2018).

Acute vaso-occlusive pain assessment and management

Most painful vaso-occlusive crises are managed at home, with patients usually seeking hospital care only if pain is uncontrolled or they have no access to analgesia (NICE 2012). NICE (2012) guidelines recommend that individuals who present to hospital in acute painful vaso-occlusive crisis should have their pain assessed, a clinical assessment completed (including blood pressure, oxygen saturation levels, heart rate, respiratory rate and temperature checks), and receive appropriate analgesia within 30 minutes of presentation. Immediate nursing care should be linked to an integrated care pathway for vaso-occlusive crisis in emergency departments. This should ideally be supported by input from the hospital pain team service with the aim of early discharge, once the patient’s pain has been managed effectively (NICE 2014). Patients who speak little or no English should also be given access to a professional translator (Hadziabdic and Hjelm 2013).

Vaso-occlusive crises can be extremely painful, and therefore patients often require strong analgesics to provide pain relief (Jenerette and Brewer 2010, Manwani and Frenette 2013). Accurate pain assessment will lead to effective symptom management and pain relief. NICE (2012) guidelines recommend the use of a pain assessment scale such as the visual analogue scale (VAS), in which the patient rates the severity of their pain on a linear scale from 0 to 10, with 0 indicating ‘no pain’ and 10 indicating the ‘worst pain experienced’.

NICE (2012) guidelines recommend a bolus dose of a strong opioid to patients presenting with severe pain (VAS score of more than 7), or those with moderate pain (VAS score of 4-7) who have already had some analgesia before presentation. Alleviating vaso-occlusive pain often requires high doses of opioids to achieve therapeutic plasma levels (Sickle Cell Society 2018), which some healthcare professionals may not be used to administering or prescribing. It has been reported that subcutaneous morphine administration and fentanyl lozenges are relatively easy to administer and effective in reducing pain in the immediate acute intervention stages (De 2008). Distractive coping methods for pain, such as handheld gaming devices, may also be useful for some patients (Jameson et al 2011).

Key points

- Sickle cell disease is the most common serious and life-limiting genetic disorder in the UK
- Sickle cell disease occurs predominantly in individuals of black African or African-Caribbean descent, although it is also prevalent in the Eastern Mediterranean, Middle East, India, and South and Central America
- The immense pain experienced by people with sickle cell disease can have life-limiting effects for patients and negatively affect their quality of life
- An individualised, person-centred approach will lead to improvements in the quality of care experienced by patients with sickle cell disease

The administration of analgesics in patients with sickle cell disease has been traditionally based on the World Health Organization’s (2019) Pain Ladder tool, in conjunction with the patient’s individualised care plan. Therefore, patients’ care plans and requirements for analgesics should be reviewed in acute care settings and mutually agreed by patients and healthcare professionals, to ensure the appropriate doses of analgesics are being administered. Accurate recording of previously prescribed doses of these analgesics could assist in informing subsequent hospital admissions, provide continuity of care and ensure that pain relief is individualised and appropriate. However, it remains necessary to monitor patients for opioid misuse or addiction (Lanzkron and Haywood 2015), and to review the effectiveness of any pain relief interventions used (Kotila et al 2015).

The administration of fluids is also recommended in acute vaso-occlusive crisis (NICE 2014). However, it is important that nurses and paramedics do not spend lengthy amounts of time attempting to obtain venous access to administer fluids, and instead ensure analgesics are administered promptly. Patients with sickle cell disease often have suboptimal venous access (Shah et al 2012), so oral fluid intake should be the
first choice. The Sickle Cell Society (2018) guidance recommends that all patients with sickle cell disease have a minimum fluid intake of 3 litres per day.

**Hydroxyurea**

Hydroxyurea, also known as hydroxyureabamide, is a cytotoxic drug that has been successful in reducing the frequency of vaso-occlusive crises and the need for blood transfusions in some cases (NICE 2016). It is the only medicine licensed in the UK for the prevention of recurrent vaso-occlusive crisis in patients with sickle cell disease (Qureshi et al 2018). In sickle cell disease, hydroxyurea can increase haemoglobin levels and reduce intercellular adhesion, which results in improved blood flow and can lessen vaso-occlusions in some patients (Qureshi et al 2018). Hydroxyurea has been successful in reducing mortality in adults and children, the number of painful vaso-occlusive crises, and cases of acute chest syndrome (Wang 2016). However, it remains underused, primarily because it has the potential to cause teratogenic fetal malformations (Ballas et al 2012). The British National Formulary (Joint Formulary Committee 2019) recommends consulting with a specialist centre before administering or prescribing hydroxyurea.

**Health promotion and preventing vaso-occlusive crises**

Although the average life expectancy of people with sickle cell disease has increased, in the UK it remains almost two decades shorter than that of the general population (Elmahri et al 2014, Office for National Statistics 2015). In well-resourced countries such as the US, the UK and France, 94-99% of newborns with sickle cell disease are expected to survive into adulthood (Quinn et al 2010). In contrast, in developing countries, most children with sickle cell disease die before the age of five years, primarily as a result of contracting severe infection and sepsis in infancy (Fernandes et al 2010). Patients with sickle cell disease are also at increased risk of other long-term conditions, such as diabetes mellitus, chronic kidney disease, stroke, hyperlipidaemia and cancer, as well as depression and anxiety (Adam et al 2017).

The immense pain experienced by people with sickle cell disease can have life-limiting effects for patients and negatively affect their quality of life (Ballas et al 2012). Box 2 lists some of the factors that may trigger a vaso-occlusive crisis in some individuals. However, nurses should be aware that many vaso-occlusive crises occur with no identifiable origin and therefore cannot be foreseen.

Nurses can provide advice to patients on self-management strategies to prevent vaso-occlusive crisis, exacerbations and complications. Such strategies may include encouraging patients to: drink plenty of fluids; take warm baths; wear appropriate clothing during adverse weather conditions; avoid being positioned near air vents; and refrain from undertaking strenuous activities and those that may cause extreme changes in altitude, such as flying, or temperature, such as swimming (Sickle Cell Society 2018).

Leg ulcers are common in patients with sickle cell disease, and can be extremely painful, challenging to treat and often recurrent (El Khatib and Hayek 2016). Management of sickle cell leg ulcers includes wound care, debridement and skin grafts (El Khatib and Hayek 2016). Sickle Cell Society (2018) guidance recommends preventing leg ulcers through a well-balanced diet, avoiding injury and using moisturisers. As with any suspected wound infection, nurses should implement early swabbing of any malodorous or inflamed leg ulcers and administer antibiotics as appropriate. Timely referral to the tissue viability service would also be beneficial.

**Barriers to care**

When patients with sickle cell disease seek treatment for vaso-occlusive pain in an emergency department, there is potential for racial stereotyping by healthcare professionals towards patients. Jenerette and Brewer (2010) found that white patients were significantly more likely to be prescribed opioids than black patients in emergency departments. This may result in inadequate pain management and mistrust related to perceived drug-seeking behaviour (Clarke and Iphofen 2008, Sickle Cell Society 2018).

Evidence has also demonstrated that healthcare professionals often view patients with sickle cell disease negatively, primarily because of the high doses of opioids they require (Ruta and Balls 2016). There is also a belief among some healthcare professionals that patients with sickle cell disease misuse or are addicted to opioids, which may result in patients’ pain being undertreated (Ruta and Balls 2016).

Despite significant improvements in healthcare professionals’ understanding of vaso-occlusive crises, there are well documented variations in the standard of care received by patients with sickle cell disease in acute care settings and emergency departments (National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) 2008, Sickle Cell Society 2018). A lack of knowledge of sickle cell disease remains the most prevalent cause of substandard care, and there are increasing concerns that healthcare professionals in acute care settings have insufficient skills and competence to manage sickle cell disease effectively (SCTAPPG 2018). In areas with a low prevalence of sickle cell disease, a lack of exposure to patients with sickle cell disease may mean that some healthcare professionals might

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**Box 2: Factors that may trigger a vaso-occlusive crisis**

- Hypoxia
- Acidosis
- Dehydration
- Infection
- Physical exertion or extreme fatigue
- Trauma
- Sudden temperature alterations
- Stress, anxiety, excitement or sexual arousal
- Vascular strain – for example pregnancy, menstruation or puberty
- Changes in altitude

(Adapted from Maakaron and Taher 2019)
not have developed the skills to effectively identify and manage patients who are experiencing a vaso-occlusive crisis (De 2008). There is also a lack of knowledge among healthcare professionals in acute settings of the potentially fatal nature of genetic conditions such as sickle cell disease and thalassaemia (Picker Institute Europe 2015). Furthermore, with increasing responsibility placed on primary care nurses to implement screening and prevention measures, and make referrals to specialist haematology services, it is essential that community-based nurses have an understanding of these genetic conditions (Royal College of Nursing 2016). Similarly, healthcare professionals involved in newborn blood spot screening must be competent in identifying babies with sickle cell disease, so that early treatment such as immunisations and prophylactic antibiotics can be commenced.

Strategies to improve care

An individualised, person-centred approach will lead to improvements in the quality of care experienced by patients with sickle cell disease (NICE 2014, Sickle Cell Society 2018). Care can also be improved by patients carrying a personalised medical passport that provides core information about their condition and healthcare requirements (Isokariari 2016); however, finding these during a painful vaso-occlusive crisis may be challenging. Since most people now own mobile phones, the use of handheld tele-data could be a practical and contemporary solution. Acute care and specialist public health nurses could be well placed to promote some of the necessary cultural shifts in thinking regarding sickle cell disease prevalence. Kirk et al (2013) suggested short digital patient stories could raise awareness of genetic education sources and enhance practice among healthcare professionals.

The National Haemoglobinopathy Registry (NHR) (nhr.mdsas.com) is a UK database for monitoring patients identified as having a red cell disorder, predominantly sickle cell disease and thalassaemia major. Information obtained from the NHR could assist healthcare organisations in securing ongoing resources to improve the care and treatment of patients with sickle cell disease. Identifying deficits in care could also support the case for employing more specialist practitioners, who could provide improved outreach care for patients with sickle cell disease, and could forge support links with nurses in local or regional emergency departments and acute care settings. Establishing networks with other acute treatment centres or medical and haematology wards would also be beneficial for patients with sickle cell disease.

Education and training

Improving nurses’ competency in the assessment, management, evaluation and timely escalation of concerns could contribute towards reducing morbidity and mortality associated with sickle cell complications (NCEPOD 2008). The Sickle Cell Society (2018) recommends targeting increased resources at healthcare professionals in acute care settings as an appropriate educational investment.

Another concern is that nursing students may not be adequately prepared to consider the UK’s increasingly culturally diverse population demographic. The SCTAPPG (2018) report suggested that by not incorporating sickle cell disease in nurse undergraduate programmes, education institutions are failing to address important aspects of equality and diversity. The updated Nursing and Midwifery Council (2018) standards of proficiency for registered nurses state that they must be able to consider patients’ diverse backgrounds and cultural characteristics. Therefore, it may be necessary for nurse educators to review their curriculum content and include components related to diversity and haemoglobinopathies. There is also a need for multidisciplinary team training in sickle cell disease to ensure effective and culturally sensitive care (De and Richardson 2013).

Conclusion

Sickle cell disease is a serious inherited disorder. It is considered life-limiting and can cause chronic anaemia, acute pain, and multiple organ damage. Investing in resources to prioritise training in the care of patients with sickle cell disease in acute care settings is recommended to improve recognition of symptoms, prevent complications and enhance healthcare professionals’ understanding of genetics. Encouraging nurses in emergency departments to actively listen to patients as the experts in their condition would also raise awareness of haemoglobinopathies in acute care settings. This person-centred approach could also assist in restoring confidence in patients with sickle cell disease who need to access emergency services during a painful vaso-occlusive crisis.

References


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