Sickle Cell Disease (SCD)

What is SCD?

A rare hereditary blood disorder that leads to a shortened life span and serious complications in many patients, including chronic iron overload in patients receiving blood transfusions.

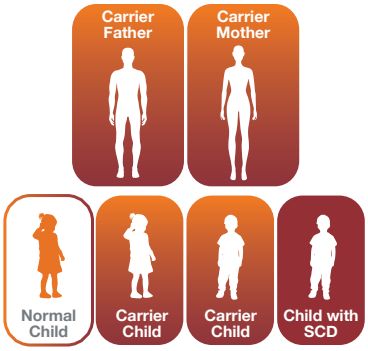


Fig. 1

Sickle cell disease (SCD) is a hereditary blood disorder characterized by sickle-shaped red blood cells. It is a chronic, life-long, debilitating disease with many forms that can range in clinical severity from asymptomatic to life-threatening.[1,2]

Individuals can be carriers of the sickle cell gene but never experience any symptoms of the disease. Individuals who carry two copies of the sickle cell gene, one from each parent, as seen in Figure 1, experience symptoms of a chronic, life-long, debilitating disease.[2] A simple blood test can identify whether a person is a carrier of a sickle cell gene that could be passed on to a child.

Stroke is one of the most devastating effects of SCD and is responsible for many deaths, especially in children.[3,4] Many children with SCD, particularly those born in developing countries, die undiagnosed because they have little or no access to medical care.[5] Many others die later from disease complications, including stroke and severe infections, and from the consequences of chronic iron overload resulting from blood transfusions.[3] Transfusions are sometimes given to help manage SCD, especially in patients at risk for stroke.[3] Recent research also shows that childhood mortality from SCD has decreased significantly, but proper care during the transition from childhood to adulthood is critical to maintaining healthy patients.[6]

Prevalence and Cause of SCD

The World Health Organization estimates that about 275,000 babies are born annually with SCD globally.[5] In the US, SCD affects an estimated 90,000 to 100,000 Americans.[7] Although SCD occurs predominantly in individuals of African descent, sickle cell disorders are also prevalent throughout the Mediterranean, Middle East and parts of India, the Caribbean, and South and Central America.
In parts of Africa and India, the prevalence of the sickle cell trait is as high as 30 percent.[8]

In SCD, red blood cells contain an abnormal form of hemoglobin, the oxygen-binding part of the red blood cells.[9] When these blood cells do not receive enough oxygen, they adopt a sickle shape, as seen in Figure 2. This structural variation leads to the obstruction of blood vessels, reduced blood flow to vital organs, and a weakened immune system.[9]

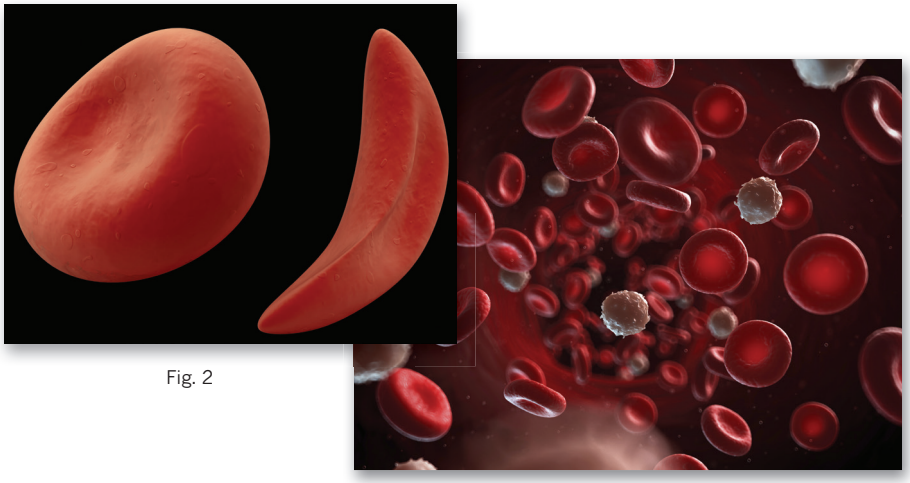
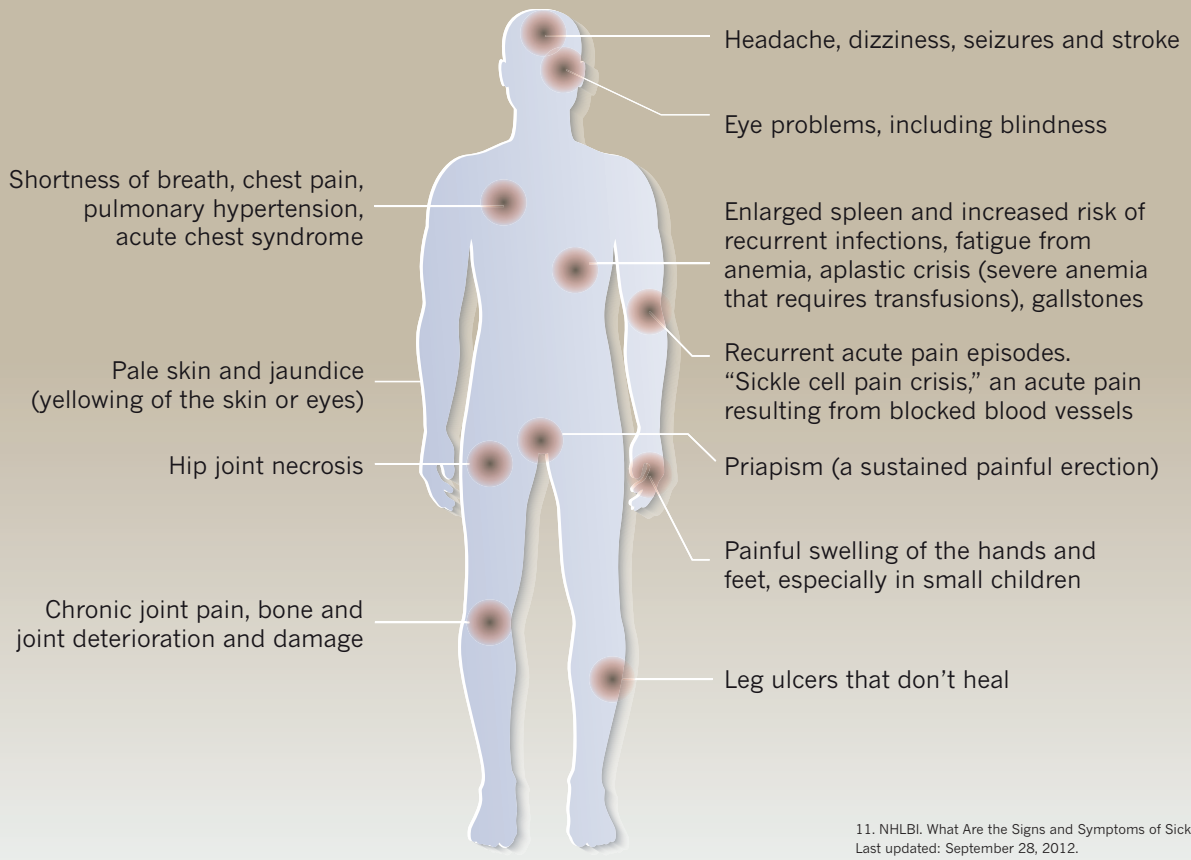


Fig. 2

Symptoms and Complications of SCD



11. NHLBI. What Are the Signs and Symptoms of Sickle Cell Anemia? Last updated: September 28, 2012.

Patients with SCD often suffer from recurrent infections, chronic pain, stroke and other severe complications.

Diagnosis of SCD

In the past, SCD was diagnosed in young children who developed painful swelling of the feet and hands, a consequence of blood vessel blockage.[9] In the developed world, the disease is now commonly detected during routine newborn genetic screening.[10] Carriers of the sickle cell gene can be identified by a simple blood test.

Patients' life expectancy can be greatly improved by simple medical care, such as early diagnosis, education, access to antimalarial medication and antibiotics, and access to blood transfusions and hospital treatment.[5] However, in many regions of the world, these measures are not available and management remains inadequate.[5,12]

Treatment of SCD

SCD is a lifelong condition. By early childhood, patients with SCD often suffer from recurrent infections, chronic pain, stroke and other severe complications. Patients' chronic anemia usually worsens during adolescence and organ damage can occur.[13]

Even in developed countries where patients have access to medical care, many do not keep to their treatment plan, and can start to develop serious complications. As young adults with SCD in many countries, including the US, are living longer, transitioning seamlessly from a pediatrician to an adult primary care provider has become critical for long-term disease management.[14]

Chronic Iron Overload due to Blood Transfusions in SCD

Patients with sickle cell disease can be treated in a number of ways. Some are treated with occasional or frequent blood transfusions to increase the amount of normal shaped cells, help restore normal blood flow, and reduce serious complications such as stroke.[10] Multiple blood transfusions can lead to iron accumulation because the body has no mechanism to remove excess iron.[15] Chronic iron overload occurs when the body's limited iron storage capacities are exceeded, and starts to develop after only 10 to 20 transfusions.[16]

Excess iron accumulates in organs, increasing the risk of liver complications and reducing patient survival rates.[3]

Accurate assessment of iron in the body is essential for managing SCD and addressing the problem of chronic iron overload. Iron levels in the body are commonly measured using two methods:[17,18]

- **Serum ferritin (SF):** A noninvasive and inexpensive blood test that allows for frequent monitoring. SF tests are an indirect measurement of iron burden and can require several tests or combinations with other indicators of iron overload to increase accuracy.
- **Liver iron concentration (LIC):** A more accurate measurement of iron levels that assesses tissues in the liver, the main site of body iron storage. Testing can be done via biopsy, magnetic resonance imaging (MRI), or a superconducting quantum interference device (SQUID).

When iron overload is detected using these methods, patients can work with their doctors to monitor iron overload as part of their overall plan.

Multiple blood transfusions can lead to iron accumulation because the body has no mechanism to remove excess iron.

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