

## Diagnostic evaluation and treatment of osteoarticular lesions in patients having sickle cell anemia: Literature review

Avaliação diagnóstica e tratamento da lesão osteoarticular em pacientes com anemia falciforme:

Revisão de literatura

Evaluación diagnóstica y tratamiento de lesiones osteoarticulares en pacientes con anemia falciforme: Revisión de literatura

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### Abstract

Sickle cell anemia is a genetic disorder in which the structure of hemoglobin undergoes a significant alteration through a point mutation in the  $\beta$ -globin gene. When the gene is altered in sickle cell disease, hemoglobin S is expressed, causing the red blood cell to acquire the characteristic sickle shape. Thus, in the presence of this mutation, especially with changes in oxygen concentration and pH, hemoglobin S tends to polymerize, resulting in sickling of the red blood cells, leading to a shortened lifespan of red blood cells, vascular occlusion phenomena, and episodes of pain and organ damage. Among the complications caused by sickle cell disease, stroke, recurrent infections, osteoarticular disease, among others, can be mentioned. One of the complications that generates the greatest morbidity is osteoarticular lesions, which can present with symptoms such as pain, swelling, warmth, fever, reduced vascularization, and even necrosis. Therefore, this study aimed to evaluate the diagnostic methods used in osteoarticular lesions in patients with sickle cell anemia. Among the most commonly used diagnostic methods in patients with sickle cell disease suspected of osteoarticular lesions, we can emphasize imaging diagnostic methods such as X-rays, magnetic resonance imaging (MRI), scintigraphy, and PET-CT, which can be used to differentiate between different types of lesions and suspected infectious processes, such as osteomyelitis. Therefore, imaging diagnostic methods are essential in identifying the lesion and the best treatment, with total hip arthroplasty being the most invasive method, although it is often the initial choice due to the severity of the lesion, or it is used after unpromising results from other less invasive procedures, such as femoral head decompression, grafting, and subchondroplasty.

**Keywords:** Sickle cell anemia; Osteoarticular lesions; Imaging diagnostic methods; Complications; Treatment.

### Resumo

A anemia falciforme é um distúrbio genético no qual a estrutura da hemoglobina sofre uma alteração significativa por meio de uma mutação pontual no gene  $\beta$ -globina. Quando o gene é modificado na doença falciforme há expressão da hemoglobina S, em que o eritrócito adquire o formato característico de foice. Assim, na presença dessa mutação, especialmente com as alterações de concentração de oxigênio e pH, a hemoglobina S tende a se polimerizar, ocorrendo a falcização das hemácias, trazendo como consequências o encurtamento da vida média dos glóbulos vermelhos, fenômenos de vaso oclusão e episódios de dor e lesão de órgãos. Diante das complicações causadas na

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doença falciforme, podemos citar o acidente vascular cerebral (AVC), infecções de repetição, doença osteoarticular, dentre outras. Uma das complicações que geram maior morbidade são as lesões osteoarticulares, podendo apresentar desde dor, edema, calor, febre, redução da vascularização e até necrose. Desta forma, esse trabalho teve como objetivo avaliar os métodos de diagnóstico utilizados nas lesões osteoarticulares em pacientes com anemia falciforme. Dentre os métodos de diagnóstico mais utilizados em pacientes com a doença falciforme com suspeita de lesões osteoarticulares, podemos enfatizar os métodos de diagnóstico por imagem, como a radiografia, ressonância nuclear magnética, cintilografia e PET-CT, que podem ser utilizados para diferenciar os diferentes tipos de lesões e suspeita de processos infecciosos, como é o caso da osteomielite. Portanto, os métodos de diagnóstico por imagem são essenciais na identificação da lesão e do melhor tratamento, sendo a artroplastia total de quadril o método mais invasivo, embora muitas vezes seja a escolha inicial devido à gravidade da lesão, ou ainda, utilizada após resultados não promissores de outros procedimentos menos invasivos, como é o caso da descompressão da cabeça do fêmur, enxertos e subcondroplastia.

**Palavras-chave:** Anemia falciforme; Lesões osteoarticulares; Métodos de diagnóstico por imagem; Complicações; Tratamento.

### Resumen

La anemia falciforme es un trastorno genético en el cual la estructura de la hemoglobina sufre una alteración significativa mediante una mutación puntual en el gen de la  $\beta$ -globina. Cuando el gen se ve afectado en la enfermedad falciforme, se expresa la hemoglobina S, donde el eritrocito adquiere la forma característica de una hoz. Por lo tanto, en presencia de esta mutación, especialmente con cambios en la concentración de oxígeno y pH, la hemoglobina S tiende a polimerizarse, lo que resulta en la falcización de los glóbulos rojos, lo cual conlleva a un acortamiento de su vida media, fenómenos de oclusión vascular y episodios de dolor y lesión en órganos. Entre las complicaciones causadas por la enfermedad falciforme, se pueden mencionar el accidente cerebrovascular (ACV), infecciones recurrentes y la enfermedad osteoarticular, entre otras. Una de las complicaciones que generan mayor morbilidad son las lesiones osteoarticulares, que pueden manifestarse con dolor, edema, calor, fiebre, reducción de la vascularización e incluso necrosis. Por lo tanto, este trabajo ha tenido como objetivo evaluar los métodos de diagnóstico utilizados en las lesiones osteoarticulares en pacientes con anemia falciforme. Entre los métodos de diagnóstico más utilizados en pacientes con enfermedad falciforme con sospecha de lesiones osteoarticulares, podemos enfatizar los métodos de diagnóstico por imágenes, como la radiografía, la resonancia magnética nuclear, la gammagrafía y el PET-CT, que pueden utilizarse para diferenciar los diferentes tipos de lesiones y sospecha de procesos infecciosos, como es el caso de la osteomielitis. Por lo tanto, los métodos de diagnóstico por imágenes son esenciales en la identificación de la lesión y el mejor tratamiento, siendo la artroplastia total de cadera el método más invasivo, aunque a menudo es la elección inicial debido a la gravedad de la lesión, o también se utiliza después de resultados poco prometedores de otros procedimientos menos invasivos, como es el caso de la descompresión de la cabeza femoral, los injertos y la subcondroplastia.

**Palabras clave:** Anemia falciforme; Lesiones osteoarticulares; Métodos de diagnóstico por imagen; Complicaciones; Tratamiento.

## 1. Introduction

In 1910, American physician James Herrick presented sickle cell anemia to the scientific community based on a blood sample from a patient from the island of Granada in the Caribbean. Sickle cell anemia is a group of hereditary disorders, passed from parents to children, in which red blood cells assume a sickle shape. These cells die prematurely, causing a shortage of healthy red blood cells and thus anemia. Additionally, the incorrect shape of these cells can obstruct blood flow, causing pain, fatigue, and susceptibility to infections, characteristic symptoms of sickle cell disease (Brasil, 2014).

This disease originated in the African continent and is more prevalent in the Black and mixed-race population, so the Brazilian population, which is mixed with Blacks, Indigenous people, and Europeans, presents data of around 3,500 children born in Brazil with sickle cell anemia and around 200,000 with sickle cell trait, which is of high epidemiological relevance. Statistics indicate that there may be around 60,000 people with sickle cell anemia in Brazil, and clinical manifestations of the disease begin in the first year and persist throughout life (Brasil, 2002).

Sickle cell anemia is a genetic disorder in which the hemoglobin of the  $\beta$ -globin gene undergoes alteration, losing its original round characteristic and acquiring a concave shape, also known as a sickle or crescent shape (Machado et al., 2018).

There is a point mutation in sickle cell anemia, and in these cases, hemoglobin polymerizes, leading to sickling of red blood cells, shortening their lifespan, vascular occlusion phenomena, and episodes of pain and organ damage.

Currently, in Brazil, the main diagnosis for sickle cell disease is neonatal screening, also known as the heel prick test, which is performed in health units (Meier, 2018). However, when talking about sickle cell anemia, reference is made to a generic term used to characterize the group of genetic alterations in which hemoglobin S predominates with the presence of other hemoglobin variants, such as hemoglobin C, hemoglobin D, and interactions with thalassemias (hemoglobin S/thalassemia). To diagnose the various forms of sickle cell diseases, mainly electrophoresis is used, a method used to separate nucleic acids and proteins using electric charges. Other methods for diagnosis include blood count and measurement of fetal hemoglobin (Alencar et al., 2015).

Late diagnosis becomes complicated because patients present with various symptoms. Pathologies derived from sickle cell anemia that will occur throughout their lives include recurrent infections, pulmonary, neurological, renal, hepatobiliary, ocular complications, priapism, and leg ulcers. Osteoarticular lesions are complications of the severe form of the disease, resulting from poor blood circulation and consequent lack of oxygenation, leading to ischemic necrosis in areas of active bone marrow (Gravitz & Pincock, 2014).

Therefore, the complications present in osteoarticular lesions have clinical symptoms such as pain, swelling, heat, redness, increased local sensitivity, and fever above 38.2°C. Laboratory tests show increased white blood cells and erythrocyte sedimentation rate, and when combined with imaging tests such as X-rays, bone scintigraphy, and magnetic resonance imaging, there is greater sensitivity in the early diagnosis of these lesions (Pinto et al., 2019).

Blood cultures are recommended to identify if there is an infection, and eventually a bone biopsy of the affected area is indicated. Etiological agents that cause complications and are present in cases of osteomyelitis include salmonellas, as well as cases by *S. aureus*, *S. pneumoniae*, *H. influenzae*,  $\beta$ -*streptococcus/Klebsiella*, and *Escherichia coli/Enterococcus* (Nuzzo & Fonseca, 2004).

With early diagnosis, prophylactic interventions such as penicillin, blood transfusion, transcranial Doppler for prevention and control of stroke, hydroxyurea use, and hematopoietic stem cell transplantation can dramatically improve survival and quality of life for sickle cell disease patients. Understanding the role of genetic and non-genetic factors in explaining the remarkable phenotypic diversity of this Mendelian disease is still limited. Better prediction of the severity of sickle cell disease can lead to more precise treatment and management (Piel et al., 2017).

## 2. Methodology

This study was carried out in the format of a narrative literature review (Rother, 2007), using information obtained from databases such as PubMed, Scielo, and Google Scholar, using the keywords: Complications of sickle cell disease, osteoarticular lesions, and imaging diagnosis. English terms (Complications of sickle cell disease, osteoarticular lesions, and imaging diagnosis) were also used, based on articles and materials produced between 1960 and 2022, with the oldest being from 1963.

Approximately seven hundred and thirty thousand articles were found, and about forty articles were selected for theoretical foundation, in addition to articles to compose the bibliographic reference.

The research was initiated using inclusion and exclusion criteria. For inclusion, articles had to be within the specified period, written in Portuguese, Spanish, French, or English. Among the exclusion criteria were literature reviews, and finally, articles that did not present the indexers used.

### 3. Results and Discussion

#### 3.1 Sickle Cell Anemia and Disease Complications

Sickle cell anemia is a genetic disorder caused by a point mutation, in which a nucleotide base change (thymine to adenine) in the sixth codon in the  $\beta$ -globin gene (beta-globin), located on chromosome 11, alters the amino acid glutamic acid to valine. This alteration of the  $\beta$ -globin chain ( $\beta$ s) causes hemoglobin S (HbS) to be expressed in red blood cells, and the concentration can vary according to heterozygous and homozygous individuals, although clinical manifestations of the disease occur only in homozygous individuals, since the concentration of HbS is much higher in these individuals (Kan & Dozy, 1978).

The presence of HbS in red blood cells in the low oxygen state undergoes a modification in its molecular conformation due to the presence of the amino acid valine, which interacts with the phenylalanine (b-85) and leucine (b-88) receptors in the adjacent hemoglobin S molecule, resulting in the polymerization of hemoglobin, causing it to lose its original round characteristic and assume a concave or sickle shape (Ballas et al., 1996). The process of sickling of red blood cells can be reversible, but with the stress of reduced oxygen, pH change, and other factors, this hemoglobin becomes dense and no longer returns to its normal state, causing these altered-shaped red blood cells to cause complications such as vaso-occlusive phenomena and episodes of pain and organ damage (Dong et al., 1992; Machado et al., 2018).

Among the various problems related to sickle cell anemia complications, we can mention stroke, recurrent infections, pulmonary, neurological, renal, hepatobiliary, ocular complications, priapism, leg ulcers, osteoarticular disease, among others (Gladwin et al., 2004; Kato et al., 2006; Khoury et al., 2011; Lacaille et al., 2021).

Considering sickle cell disease, one of the complications that generates the most morbidity is osteoarticular lesions, which can present with symptoms ranging from pain, edema, warmth, redness, increased local sensitivity, and fever, to reduced vascularization and necrosis. Blood cultures are recommended to identify if there is an infection, and, eventually, a bone biopsy of the affected area is indicated. (Nuzzo & Fonseca, 2004; Pinto et al., 2019).

Among the types of osteoarticular clinical manifestations, we can mention dactylitis (hand-foot syndrome), which is often the first manifestation of the disease and results from ischemic necrosis of the bone marrow, secondary to increased intramedullary pressure due to subsequent inflammatory process; avascular necrosis of the femoral head is another common type of clinical presentation, in which the femoral head may present various alterations with or without rupture of the articular surface, depending on the age at which the infarction occurs; and osteomyelitis, which is as common as ischemic necrosis but is associated with infection after bacteremia, mainly by *Salmonella* spp., making it difficult to differentially diagnose in the early stages of these two clinical forms (Anvisa, 2002).

#### 3.2 Osteoarticular lesions as a complication of sickle cell disease

A common involvement among the clinical manifestations of sickle cell disease (SCD) is acute pain crises due to vaso-occlusive phenomena, leading to vascular necrosis and resulting in chronic and progressive disability. Managing this clinical situation is often challenging due to diagnostic uncertainty in most laboratory and imaging exams, as well as regarding the procedures to be used (Gravitz & Pincock, 2014; Pinto et al., 2019).

A retrospective study conducted by Moalla et al. (1987) reported a frequency of 9 out of 14 cases of osteoarticular manifestations in patients with sickle cell disease, with 35% showing joint signs and 25% showing bone signs, indicating that in addition to the high prevalence of osteoarticular lesions as a complication of sickle cell disease, both bone and joint lesions may be involved.

Considering other clinical forms, among the main anatomical sites affected, we can mention the tibia, followed by the femur and humerus, as the most affected bones, with the knee being the primary joint involved in cases of osteomyelitis and

aseptic arthritis (Al-Salem et al., 1992). Distinguishing between vaso-occlusive crisis and acute osteomyelitis is important for the clinical management of the patient, but often challenging, as the clinical, radiological, and laboratory characteristics also occur in bone infarction. Osteonecrosis is a common feature in patients, with osteomyelitis responsible for 61% of cases, with *Salmonella* spp. being the most common organisms involved (Bennett et al., 1990).

In a recent study, in adults with more severe phenotypes (SS and S $\beta$ <sup>o</sup>), most osteoarticular complications were identified as osteonecrosis and osteoarthritis, with the majority of patients experiencing up to three crises per year, with severe pain and radiographic changes in 80% of patients, especially related to lesions in the spine, femur, and shoulders, and associated with non-use of hydroxyurea (Ferreira et al., 2021).

Other important radiological findings include changes in the spine, with the "step" deformity of the vertebrae being emphasized for its diagnostic value, representing the sequelae of ischemic bone lesions (Lardé et al., 1980). Additionally, other common complications include bone demineralization, cortical thinning, femoral head infarction, and ischemic aseptic arthritis (Cissé et al., 1999).

### **3.3 Diagnostic methods used in osteoarticular lesions**

The imaging diagnostic methods are an important part of diagnosing osteoarticular lesions in patients with sickle cell disease. Within this context, several techniques can be considered for identifying these lesions. Plain radiography can reveal characteristic aspects of the disease such as the skull with perpendicular striations and the "H"-shaped vertebrae, contributing to the detection of bone infarctions in more advanced stages (Yanaguizawa et al., 2008).

Magnetic resonance imaging (MRI) is invaluable in the early detection of osteoarticular changes and is important in monitoring and tracking infections, being able to detect soft tissue changes such as muscle infarctions (Yanaguizawa et al., 2008). MRI evaluations can assess bone characteristics, such as evaluating the hematopoietic marrow and avascular necrosis characteristics by assessing different types of epiphyseal marrow. Various types of epiphyseal marrow were verified, including mixed marrow (adipose and hematopoietic) (42%), adipose marrow (32%), hematopoietic marrow (16%), and hemosiderotic marrow (10%). Additionally, segmental areas of low signal intensity in various forms (ring, band, crescent, or large homogeneous area) were the most consistent MRI manifestation of avascular necrosis in patients with sickle cell disease (Vijai et al., 1988).

Furthermore, the use of MRI with contrast is extremely useful for distinguishing between acute medullary bone infarction and osteomyelitis. Umans et al. (2000) found that the use of gadolinium-enhanced MRI enabled the differentiation of these clinical forms, with osteomyelitis confirmed by isolated biopsy or by combining gallium (<sup>67</sup>) scintigraphy with positive blood cultures and clinical resolution after antibiotics, and infarctions without osteomyelitis confirmed by biopsy or symptom resolution without antibiotic therapy. Radiographically, it was observed that all adult patients with acute infarctions demonstrated fine, linear enhancement on MRI, while osteomyelitis revealed more geographical and irregular enhancement in the marrow. Additionally, two out of four cases of osteomyelitis also showed subtle cortical defects with abnormal signals crossing the marrow and soft tissues, and the only pediatric patient demonstrated elongated and serpiginous central marrow enhancement with periostitis. Thus, the enhancement pattern of MRI with contrast can allow for precise distinction between acute infarction and osteomyelitis, or recognition of osteomyelitis superimposed on bone infarction.

Other forms of assessing osteoarticular lesions through MRI are possible, as demonstrated in the work of Jain et al. (2008), where an experimental study was conducted using red blood cell concentrate in vitro in normal volunteers and a retrospective clinical study. It was assessed that acute bone infarctions in sickle cell disease are caused by red blood cell sequestration in the bone marrow, and the fat-saturated T1-weighted sequence on MRI is capable of diagnosing acute bone infarctions, with contrast enhancement aiding in the early diagnosis of acute osteomyelitis, being essential for early diagnosis

and clinical treatment management and prevention with antibiotic therapy.

Meanwhile, other diagnostic techniques are also implemented, such as scintigraphy, which can also assist in identifying suspected areas of osteomyelitis. When associated with ultrasound, it is possible to identify subperiosteal fluid collections, allowing for guided aspiration. When using scintigraphy alone in suspected osteomyelitis, the image of the affected area can assist in diagnosis. Thus, bone scintigraphy imaging with Technetium 99m-labeled methylene diphosphonate (Tc99m) is highly sensitive to many active benign and malignant disorders. However, even with scintigraphy using labeled leukocytes, it is not possible to confidently discriminate between sickle cell vaso-occlusive crises and osteomyelitis. Therefore, the application of other techniques is essential, such as positron emission tomography with 18F-fluorodeoxyglucose (FDG-PET), used to establish the presence of inflammation or infection, areas with intense glucose metabolism, resulting in accumulation of the glucose analog FDG, playing an important role in evaluating osteomyelitis, especially in the acute phase. Thus, the use of PET-CT may better assist in distinguishing infarction from inflammation or infection, being a suggestion when bone scintigraphy or leukocyte scintigraphy is inconclusive (Witjes et al., 2006).

Still, scintigraphy using Technetium 99m has the ability to mark various lesions associated with sickle cell disease, as seen in a clinical case of an 11-year-old boy presenting images with characteristics of avascular necrosis of the right femoral head, in addition to Tc99m uptake in the ends of long bones at the knees, and diffuse activity observed in the spleen and kidneys, attributed to microscopic splenic calcification and/or iron deposits (Adams et al., 2003). Table 1 presents a summary of the main techniques used and the radiological findings in different osteoarticular lesions.

**Table 1 - Methods of imaging diagnosis in the identification and distinction of different osteoarticular clinical forms.**

Articles	Authors	Year	Technique used	Radiographic findings
Femoral Head Avascular Necrosis in Sickle Cell Anemia: MRI Characteristics	Vijai et al.	1988	Magnetic Resonance Imaging (MRI)	Evaluation of hematopoietic marrow, characteristics of avascular necrosis through assessment of different types of epiphyseal marrow, and identification of segmental areas of low signal intensity in variable forms (ring, band, crescent, or large homogeneous area) was the most consistent MRI manifestation in avascular necrosis.
Scintigraphy and ultrasonography in differentiating osteomyelitis from bone infarction in sickle cell disease	Rifai et al.	1997	Scintigraphy	Identification of suspicious areas of osteomyelitis, and when associated with ultrasound, it is possible to identify subperiosteal fluid collections, allowing guided aspiration.
The diagnostic role of gadolinium enhanced MRI in distinguishing between acute medullary bone infarct and osteomyelitis	Umans et al.	2000	Contrast-enhanced Magnetic Resonance Imaging (with gadolinium)	Distinction between acute medullary bone infarction and osteomyelitis: Regarding the radiographic profile, it can be observed that all adult patients with acute infarctions showed fine and linear enhancement in MRI, while in osteomyelitis, there was a more geographic and irregular enhancement in the marrow. Additionally, two out of four cases of osteomyelitis also showed subtle cortical defects with abnormal signal crossing the marrow and soft tissues, and the only pediatric patient demonstrated elongated and serpiginous central marrow enhancement with periostitis.
Positron emission tomography scans for distinguishing between osteomyelitis and infarction in sickle cell disease	Witjes et al.	2006	Positron Emission Tomography with 18F-fluorodeoxyglucose (FDG-PET))	Used to establish the presence of inflammation or infection, areas with intense glucose metabolism, playing an important role in the evaluation of osteomyelitis, especially in the acute phase, and can assist in distinguishing infarction from inflammation or infection.

Imaging diagnosis in the evaluation of sickle cell anemia	Yanaguizawa et al.	2008	X-ray	Presence of skull with perpendicular striations and the "H"-shaped vertebra, as well as contributing to the detection of bone infarcts in more advanced stages of osteoarticular lesions.
Acute bone crises in sickle cell disease: the T1 fat-saturated sequence in differentiation of acute bone infarcts from acute osteomyelitis	Jain et al.	2008	Magnetic Resonance Imaging (MRI)	A fat-saturated T1-weighted MRI sequence can diagnose acute bone infarctions, and contrast enhancement assists in the early diagnosis of acute osteomyelitis.

Source: Authors.

### 3.4 Treatments and Palliative Care

Diagnosis methods are essential in distinguishing osteoarticular clinical complications, facilitating clinical management and treatment. Among the main forms of controlling sickle cell disease complications, the use of hydroxyurea can be mentioned, which allows for increased fetal hemoglobin in relation to hemoglobin S, preventing vaso-occlusive crises, pain, and other disease complications (Piel et al., 2017).

In a recent study, it was evaluated that non-use of hydroxyurea was statistically associated with the presence of radiographic alterations, with most lesions being osteonecrosis and osteoarthritis, thus showing a high prevalence of chronic osteoarticular alterations associated with irregular medication use (Ferreira et al., 2021).

When osteoarticular complications of sickle cell disease affect the bone or joints, certain surgical techniques can be adopted to minimize the problem. In cases of avascular necrosis, an option may be femoral head decompression. This technique offers good pain relief and delays total joint arthroplasty. In addition to pain relief caused by decompression, the benefit of drilling was manifested by the prolongation of some arthroplasty outcomes, with 7.4 years (+/- 2.7 years) in the operated group versus 2.6 (+/- 2.4 years) in the non-operated group, considered a good option in the treatment of avascular necrosis of the femoral head in sickle cell disease, especially in under-equipped regions (Mukisi-Mukaza et al., 2009).

Considering avascular osteonecrosis and invasive treatment with joint replacement, where multiple surgical procedures are required during the patient's life, an effective alternative that preserves the native joint is autologous bone marrow grafting. As a minimally invasive, high-tech surgical procedure in early stages of the disease, it may avoid joint replacement in many patients in the future (Hernigou et al., 2008).

Subchondroplasty is a minimally invasive surgical procedure performed by percutaneous fluoroscopic radioscopy, showing promising results with calcium phosphate solution used in avascular necrosis. This technique aims to prevent collapse of the femoral head and delay osteoarthritic changes. Intra-articular concomitant pathologies, including femoroacetabular impingement and chondral lesions described in hips affected by avascular necrosis, should be addressed during surgery to reduce the risk of failure. Another finding observed was fluoroscopy-assisted hip arthroscopy, which is often necessary to address all pathologies and achieve better results after femoral subchondroplasty (Rayes et al., 2021).

In terms of compacted autografting techniques combined with fenestration of the femoral head and neck, and central decompression for non-traumatic osteonecrosis in the early stage, no significant difference was observed in the quality of functional recovery. Although over a four-year period, a smaller group of patients who underwent compacted autografting showed radiographic progression or needed total hip arthroplasty (Wang et al., 2020).

In cases of severely disabled patients due to osteonecrosis, total hip arthroplasty often ends up being the only surgical option according to the state of the hip. However, this technique, in addition to being invasive, has a higher rate of complications and failure incidence, requiring revisions. In a study evaluating clinical cases, a high frequency of serious postoperative infections, the need for revision, or the need for resection arthroplasty were observed, with numerous acute and

late complications (Bishop et al., 1988).

When evaluating 27 cases of hip arthroplasty due to avascular necrosis, it was found that the manifestation was bilateral in 11 patients, and in the primary operation, hard sclerotic bone was observed in nine femurs with complete obliteration of the femoral canal, four femur fractures, three of which resulted from diaphysis perforation, and high morbidity due to loosening in both cemented and uncemented prostheses (Clarke et al., 1989). Regarding the use of prostheses, in a retrospective study, there was a predominance of uncemented prostheses, and 17.6% of patients required revision surgery, with 5.8% due to joint prosthesis infection and 11.7% due to acetabular component osteolysis (Farook et al., 2019).

#### 4. Conclusion

Sickle cell anemia is a disease in which individuals can experience various complications, including osteoarticular lesions, which can vary in clinical presentation and severity. Among the diagnostic methods used in patients with sickle cell disease and suspected osteoarticular lesions, imaging diagnostic methods are particularly emphasized, with the technique varying depending on the lesion.

In cases of suspected bone or joint lesions without signs of infection, radiographic methods and magnetic resonance imaging (MRI) are effective, although MRI with contrast is also effective, especially in the early stages of osteomyelitis, where there is infectious involvement, particularly by *Salmonella spp.*

As differentiation of osteomyelitis is of utmost importance due to its severity and need for antibiotic therapy, the most effective methods that can be applied are scintigraphy and PET-CT, with the latter being even more effective in aiding the distinction between infarction and inflammation or infection.

For the treatment of lesions, total hip arthroplasty often becomes the initial option or even after unsatisfactory results from other procedures, but procedures such as femoral head decompression, autologous bone marrow grafting, subchondroplasty, and compacted autograft are therapeutic and/or palliative options. Additionally, it is crucial to mention that treating the underlying disease with hydroxyurea is essential to prevent the development and progression of these clinical manifestations.

For future research and articles, it is crucial to further explore diagnostic and therapeutic approaches for osteoarticular lesions in patients with sickle cell anemia. Investigating the efficacy of new imaging technologies, as well as improving diagnostic accuracy in the early stages of lesions, can significantly contribute to more efficient management of these complex clinical cases. Additionally, longitudinal studies are needed to assess the long-term effectiveness of different treatment options, aiming not only for symptomatic relief but also for joint function preservation and patients' quality of life. Furthermore, exploring complementary or alternative therapies, in addition to hydroxyurea use, to control symptoms and complications associated with sickle cell anemia, may be a promising area of research. Lastly, a multidisciplinary approach involving experts in hematology, rheumatology, radiology, and orthopedic surgery may be crucial for the development of comprehensive and effective clinical guidelines for managing these complex conditions.

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