ORIGINAL RESEARCH

Observational study to evaluate osteoarticular manifestation of sickle cell disease at tertiary care centre in south Gujarat

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ABSTRACT

Introduction: In India, SCD is distributed geographically in the central and western regions. It has been estimated that about 5200 live births have SCD every year. As per an Indian Council of Medical Research Survey (IJMRS), about 20% of children with SCD expired by age of two and 30% children with SCD among the tribal community died before they reach adulthoodGujarat with 89.12 lakh tribal population is expected to have at least 70,000 SCD patients. The dhodia, dubla, kukna, gamit, chaudhary, halpati, varli, kokani, kathodi, kolcha, kotwadia Due to improved survival and population movement, the global burden of SCD is increasing with the annul number of SCD new-born expected to increase from 3,00,000 to more than 4,00,000, between 2010 and 2050 **Materials and Methods:** This is a prospective single center hospital based cross sectional study. Thirty patients of known case of SCD patients who came in orthopedic OPD in New Civil Hospital, Surat between January 2019 and May 2020 included in the study. **Results:** Among the 30 patients enrolled, highest number of patients belonged to age group of 12–32 years (n=24) and while the lowest belonged to age group of <12 years. In the study, 17 patients were female and 13 patients were male. In this study, the number of patients (11/30) who were continue on therapy of hydroxyurea (HU) for at least one year were less as compared to their counterpart. In this study 6 (20%) patients had salmonella infection and rest of the patients had no active infection. Osteoarticularmanifestation was found in different bones among which hip joint was involved in highest number of patients (n= 16) followed by joint pain (n=8), tibia (n= 3), radius (n= 2), and femur (n=1). In this study, 19 patients were observed to have involvement at the epiphysis region whereas 3 patients had involvement at metaphysis region. In this study, 16 patients were found to have avascular necrosis (AVN) hip, 8 patients had joint pain, 3 patients had proximal tibia osteomyelitis. **Conclusion:** From this study it can be concluded that osteoarticular manifestation occurring in patients with SCD in where early radiological findings are not good but patients showing clinically good range of motion of joint and weight bearing capacity so we can avoid operative intervention. As sickle cell disease is genetic disorder so there is no definitive treatment of it. As infarction is the continuous process so life span of implants used in operative intervention is less. Best management of sickle cell disease is early diagnosis of disease and early evaluation and management of its complications.

Key words: Sickle cell disease, Osteoarticular manifestation

INTRODUCTION

Sickle cell disease (SCD) is an emerging public health challenge, not only in India but also globally. Estimated about 14.2 million babies will be born with sickle cell anemia between 2010 and 2050. In 2006, the world health organization (WHO) recognized SCD as global public health problem In India, it is very difficult to establish the burden of this problem accurately in the absence of gold standard- based screening programs, nationwide reporting system or registries. Gujarat with 89.12 lakh tribal population is expected to have at least 70,000 SCD patients. The

dhodia, dubla, kukna, gamit, chaudhary, halpati, varli, kokani, kathodi, kolcha, kotwadia, etc., are major tribes with documented issues of SCD. To combat SCD, Gujarat Sickle Cell Anemia Control Society (GSACS) was established in the year 2011 with target of no child birth with SCD by 2020 and prevention of SCD with decrease in morbidity

MATERIALS AND METHODS

Thirty patients of known case of SCD patients who came in orthopedic OPD in New Civil Hospital, Surat. Thorough physical examination and systemic evaluation was carried out to rule out presence of any other systemic illness.

COLLECTION OF DATA OF PATIENTS PRESENTING WITH SICKLE CELL DISEASE

1. History.
2. Clinical examination both systemic and local.
3. Radiological examination including related x-rays, CT scan,MRI done to asscess osteoarticular manifestation in sickle cell disease.
4. Investigation : Baseline (CBC,RFT,LFT,Serum elecctrolyte,HIV,HBsAG) and other indicated Specific investigation:HPLC,Hb- Electrophoresis.

INCLUSION CRITERIA

The patients with following criteria were included in the study:

1. All age groups.
2. All patients with osteoarticular manifestation in SCD.
3. Both operative and conservatively treated patients of SCD.

EXCLUSION CRITERIA

1. Patients with sickle cell trait were the sole main exclusion criterion.

Detailed history of all patients was taken. The preoperative medical evaluation of all patients was done to prevent potential complications that can be life-threatening all joint deformities were examined for any fixed varus or valgus deformities or presence of any fixed flexion contracture.

RESULTS

A prospective study of 30 number of sickle cell disease who come to opd and admitted with osteoarticular manifestation evaluated by clinical, radiological, investigatory parameter Pt.posted for surgical management.Post op follow up done by radiological measure which follow up was done 1month, 3month, 6 month Pt.

Table1: Bone involved in the osteoarticular manifestation

Bone involved	Number of patient
Femur	1
Hip joint	16
Radius	2
Tibia	3
Knee joint	6
Elbow joint	2
Joint pain	8

Table 2: Presence of infection

Infection	No of patient
Not active infection	24
Active infection (salmonella)	06

Table 3: Osteoarticular manifestation

Complication	Number ofpatient
Avascularnecrosis(AVN)hip	16
Femurosteomyelitis	1
Radiusosteomyelitis	2
Tibiaosteomyelitis	3
Joint pain	8
Elbowarthritis	2
Kneearthritis	6

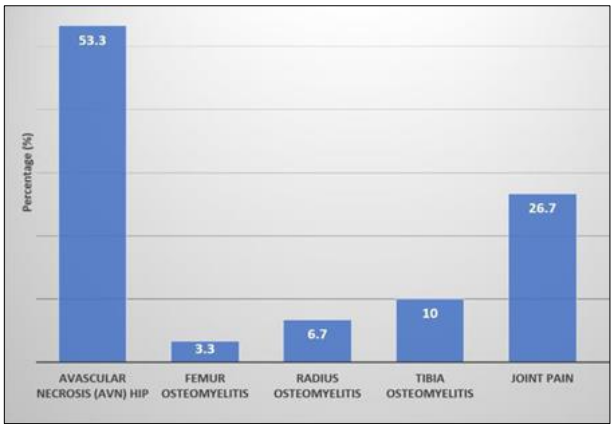

Fig 1: Osteoarticular manifestation

Table 4: Location of bone involved

Locaton of bone involved	Number of patients
Epiphysis	25
Diaphysis	1
Metaphysis	4
Total	30

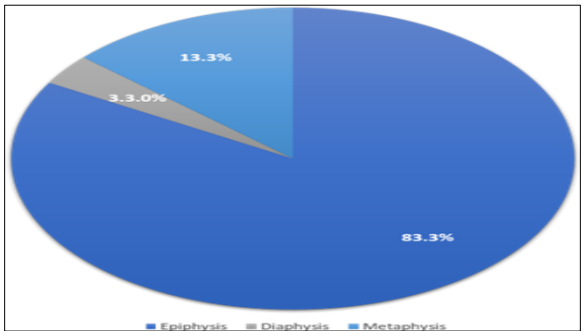

Fig 2: Location of bone involved

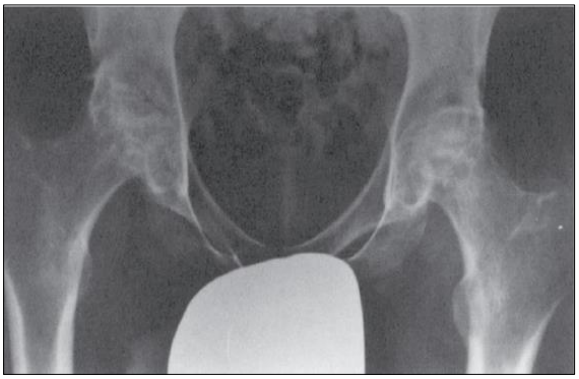

Fig 3**:** Anteroposterior radiographs of the pelvis

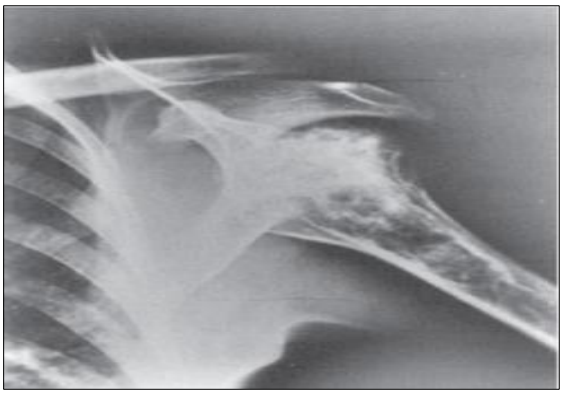

Fig 4: Anteroposterior radiographs of the shoulder

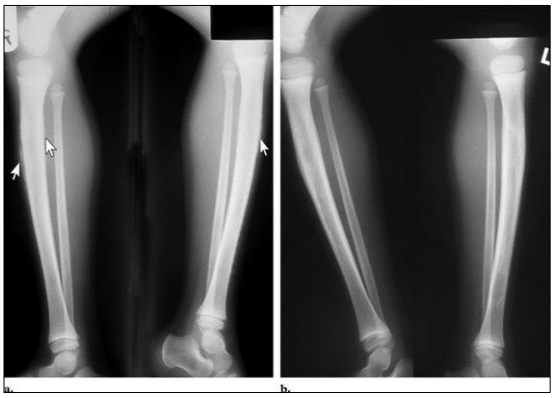

Fig 5: Bone infarction of the tibial diaphysis in a 5-year-old child.

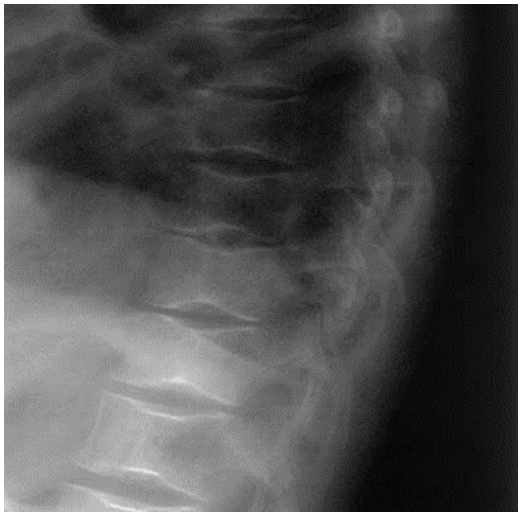

Fig 6: H-shaped vertebrae in a 15-year-old patient with sickle cell anemia. Lateralradiograph of the thoracolumbar junction demonstrates classic box like endplate depressions from osteonecrosis of the vertebral endplate.

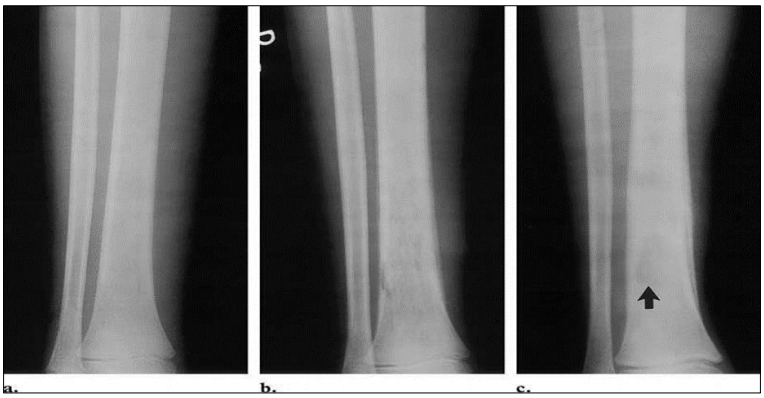

Fig 7: Salmonella osteomyelitis in a 10-year-old boy with sickle cell anemia

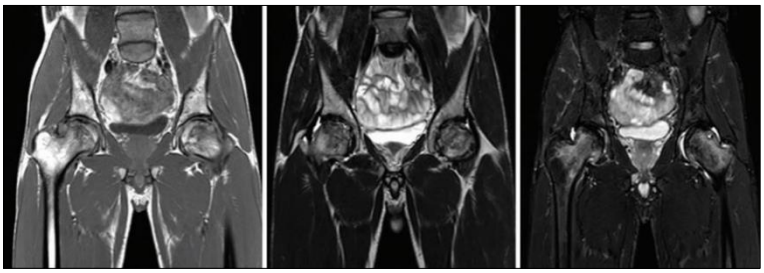

Fig 8: Case of bilateral avascular necrosis Grade III (Ficat and Arlet classification) T1 coronal. (b) T2 coronal. (c) STIR corona

DISCUSSION

SCD is a group of inherited blood disorders in which normal round RBC are defective having a shape of farm tool called "sickle". The RBC in an individual with SCD has stiff architecture leading to increased blood viscosity. Such RBC has inefficient oxygen carrying capacity, low tissue perfusion rate as a result a short life span. The problematic situation lies where these dead RBC flowing through small blood vessels get stuck and compile in the small blood vessels obstructing the blood flow which could lead into tissue hypoxia, and, if prolonged, cell death, tissue necrosis/infarction, and progressive organ damage. This might cause disruption in normal body functions, cause pain, other serious complications such as infections, acute chest syndrome and stroke. Bone involvement is common in patients with SCD as like osteonecrosis in hip and shoulder due to minimal collateral circulation and weight bearing regions which cause chronic bone and joint damage in this study, among the different age groups, 40.0%, 40.0% and 10.0% patients belonged to 12-22 years, 23-32 years and 33-42 years age group respectively. While 3.3%, 3.3% and 3.0% patients were in age group <12 years, 53-62 years and 43-52 years age group, respectively. The findings suggest that the bone related manifestations are most likely to occur in early age whilethe elderly people are seen least with such manifestations caused dueto SCD. Also, 56.7% patients were female, and 43.3% patients were male. Similar results were observed in a descriptive cross-sectional study done by Brahme*et al*. that among the patient population with SCD, majority of patients i.e., 48.8% were in the age group of 12-20 years followed by 36.5% were in the age group of 21-30 years and 14.7% were in the age group of 31-40 years where 56.1% were males and 43.9% were female patients. These findings are supportive in relation to a study stating that abnormal bone mass density in SCD population is independent of sex, and age Majority of patients i.e., 56.7% of the study cohort belonged to tribal community. Tribal population which accounts for 8.6% of the Indian population has prevalence rate of SCD varies between 1-40% among the tribal groups as mentioned in the review of literature. As there are several tribes and groups tested for SCD gene, from which is scheduled tribe in India showed most prevalence of SCD gene. As genetic mutation that led to production of sickle haemoglobin, which affects the function of red blood cell in the body. This mutation is inherited from parents of an individual. The haemoglobin S gene which is responsible for altered haemoglobin and RBC, is passed on when both parents must carry the gene mutation through a process known as autosomal recessive pattern of inheritance. Autosomal means that the mutation is not unique to X or Y chromosome and can therefore, affect male and female equally. Recessive means that the mutation must be present in both the father and mother in order for the child to have sickle cell disease. When both parents are usually asymptomatic, they may not realize that they are carriers of mutation. In this study, 20.0% patients were observed to be infected with salmonella. From a review done by Adeyokunnu A *et al.* in 63 Nigerian children, 61 patients had salmonella osteomyelitis associated with

HbS in homozygous or heterozygous state. For majority of population multiple sites were involved and lesions were usually bilateral and often symmetrical. In a study of 166 patients SCD, Connor had analyzed them for various types of infections and found among the patient population, 67 patients suffered from bacterial pneumonia and 12 patients suffered from osteomyelitis with destructive bone lesion. Salmonella was the commonest cause of osteomyelitis and half of the patients in series had urinary tract abnormality. Also, in an investigation of 57 patients by Bennett O *et al.* osteomyelitis was reported in 61% of cases among which 71% had infection due to salmonella. While salmonella septic arthritis was reported in mere two patients. Twenty-nine patients had radiological changes in the epiphyseal ossification centers of the long bones indicating necrosis and often more than 1 bone site was affected. Osteoarticular manifestation can occur in different bones in body such as femur, tibia, radius, hip joints, elbow/knee joints and others. Our results found that hip joint (53.3%) is highly affected in patients with SCD followed by joint pain (26.7%), tibia (10.0%), elbow joint (6.7%), radius (6.7%) and femur (3.3%). In a study by Ferreira *et al.* among 55 patients, 140 lesions were observed, most of which were located in the spine, femur, and shoulders. Most lesions were osteonecrosis and osteoarthritis and were associated with the non-use of hydroxyurea. Avascular Patients with intractable pain and are medically fit to undergo the procedure, total hip arthroplasty is the mainstay of treatment of advanced stages of the disease providing substantial relief of pain and improvement of function, although the surgical risk in patients with SCD is high. In a study by Aslanidis S *et al.*from nine cases of aseptic monoarthritis in a total of six patients had been reported, all of them in weightbearing joints of the lower extremities. In cases of arthritis of peripheral joints of the upper extremities, as in our patient, the possibility of a peripheral bone infarct, even though very rare, should be taken into consideration. In a study by Powars*et al.*,15.0% of the cohort was found with osteonecrosis. Another differential result of the present study was based on the location within a bone where specific infraction took place, majority of the manifestations occurred at epiphysis involving 83.3% patients, 13.3% at metaphysis and 3.3% at diaphysis. In vaso-occlusive crisis such as osteonecrosis, bone infraction is commonly observed in medullary cavities and epiphyses where proximal humerus, proximal femur, and vertebral bodies are often affected Though dactylitis is common below 3 year of age in sickle cell disease, we included patients which are directly came in orthopaedic OPD. Percentage of patients suffering from osteoarticular complications in this study with AVN hip, knee arthritis and proximal tibia osteomyelitis were 53.3%, 20.0% and 10.0%, respectively. Radius osteomyelitis and elbow arthritis was reported in 6.7% patients each followed by femur osteomyelitis in 3.3% patients. Study performed by Milner *et al.* [32] pointed evidence where patients with SCD showed synovitis along with joint destruction and plasma infiltration, arthritis was marked symmetrical in 60.0% while polyarticular was 80.0% of patients. In a retrospective investigation by da Silva *et al.* [15] demonstrated that the prevalence of septic arthritis among 2000 population with SCD was 3.0% only. As bone microcirculation is common site for RBC sickling, it ultimately leads to thrombosis, infarct and necrosis. Study data on osteoarticular complications mainly characterized by osteonecrosis, osteomyelitis and arthritis are more in tribal population of India as genetic mutation that led to production of sickle haemoglobin, which affects the function of red bloodcell in the body. Osteomyelitis is the most typical joint infection in patient with SCD. It is commonly reported manifestation for patient population of SCD than general population.In one study by Epps CH Jr *et al.* [33] in study population of 15 children observed that five patient had multiple sites of infection, which tended to presentsimultaneously.

CONCLUSIONS

Findings of this observational study with 30 patients demonstrates that majority of SCD patients belonged to tribal community. There were 36.7% patients who were on Hydroxyurea therapy. Majority of patients were reported with no active infection while only 20.0% patients had active infection due to Salmonella as sickling of RBC within mesonic vessel and resulting infarction of part of Gastrointestinal track thought to be the cause of bacteremia. Hip joint was the most common site for osteoarticular changes followed by joint pain and tibia bone. Epiphysis is found to be typical site of bone infraction due to anatomically blood supply are more vulnerable at this region. Highly observed osteoarticular complications was AVN hip followed by knee arthritis, and tibia osteomyelitis. From this study it can be concluded that osteoarticular manifestation occurring in patients with SCD in where early radiological findings are not good but patients showing clinically good range of motion of joint and weight bearing capacity so we can avoid operative intervention. As sickle cell disease is genetic disorder so there is no definitive treatment of it. As infarction is the continuous process so life span of implants used in operative intervention is less. Best management of sickle cell disease is early diagnosis of disease and early evaluation and management of its complications. It's also much under-reported issue as the literature search did not highlight any study showing prevalence of osteoarticular manifestations apart from some case series and case reports in recent time. Insights gained from the study can aid in identifying clinical characteristics of SCD in Indian population, which may be beneficial to achieve appropriate and timely management. Further investigation with large sample size and comparative

arm of patient with SCD could illustrate clearer picture about this condition.

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