

## HUMANITARIAN AND RESOURCE-LIMITED SETTING

# Sickle cell disease in anaemic children in a Sierra Leonean district hospital: a case series

Maria B Italia<sup>1,\*</sup> and Sandy Kirolos<sup>2</sup><sup>1</sup>Medical Department, Médecins Sans Frontières, 08001 Barcelona, Spain <sup>2</sup>Paediatric Department, Koinadugu Government Hospital, Kabala, Sierra Leone

\*Correspondence address. Medical Department, Médecins Sans Frontières, 08001 Barcelona, Spain. Tel: + 5411 4528 7838; Fax: + 5411 4719 5351; E-mail: mbicenere@gmail.com

## Abstract

Sickle cell disease (SCD) is the most common inherited haemoglobinopathy worldwide, with the highest prevalence in sub-Saharan Africa. Due to the lack of national strategies and scarcity of diagnostic tools in resource-limited settings, the disease may be significantly underdiagnosed. We carried out a 6-month retrospective review of paediatric admissions in a district hospital in northern Sierra Leone. Our aim was to identify patients with severe anaemia, defined as Hb < 7 g/dl, and further analyse the records of those tested for SCD. Of the 273 patients identified, only 24.5% had had an Emmel test, among which 34.3% were positive. Furthermore, only 17% of patients with a positive Emmel test were discharged on prophylactic antibiotics. Our study shows that increased awareness of SCD symptoms is required in high-burden areas without established screening programmes. In addition, the creation or strengthening of follow-up programmes for SCD patients is essential for disease control.

## INTRODUCTION

Sickle cell disease (SCD) is one of the most common monogenic diseases worldwide [1]. An estimate of 300 000 babies are born each year with the condition, and this figure is expected to increase to 400 000 in 2050 [2]. The highest prevalence is found in sub-Saharan Africa where almost 80% of the disease burden occurs [2].

SCD-associated morbidities such as acute severe anaemia, vaso-occlusive crises, stroke and severe infections can be minimized by early diagnosis, antibiotic prophylaxis, immunization, malaria prevention and education of healthcare workers, patients and caregivers [3].

Despite SCD having been declared a public health priority by the World Health Organization (WHO) in 2006 [4], resource-limited settings, where the bulk of SCD occurs, still lack clearly designed control programmes [5]. This may be explained by

the scarcity of accurate data, and consequently, the under-recognition of this health condition as an important cause of childhood mortality and morbidity [6].

In sub-Saharan Africa, 50–90% of children with SCD die before their fifth birthday [7], while in countries with established newborn screening and treatment programmes, over 90% of affected children survive well into adulthood [8]. Accurate diagnosis is a challenge, with confirmatory methods such as haemoglobin electrophoresis not being widely available in humanitarian and resource-limited settings (HRLS). The Emmel test, a screening test based on the observation of sickling of red blood cells when exposed to low oxygen tensions, is often the only option available. However, it cannot distinguish between sickle cell trait (i.e. heterozygote carriers) and sickle cell disease.

Here we describe a series of paediatric patients with severe anaemia and subsequent positive Emmel testing for suspected SCD.

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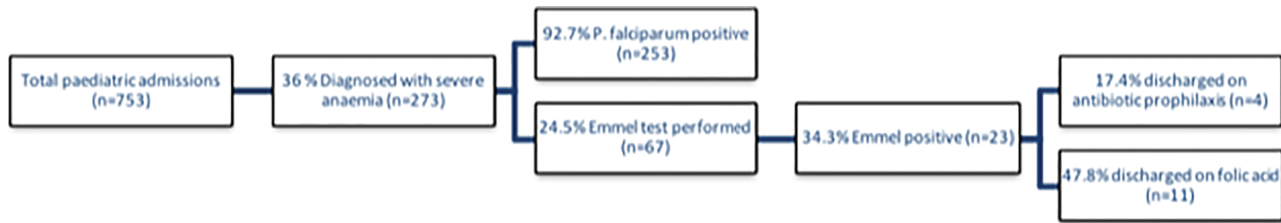


Figure 1: Total paediatric admissions during study period: patients with severe anaemia tested for *P. falciparum* and sickle cell disease (Emmel).

## PATIENTS AND METHODS

The case notes of all paediatric admissions (children younger than 12 years) in an Médecines Sans Frontières-supported district hospital in the Northern Province of Sierra Leone were reviewed retrospectively over a period of 6 months (1 February to 31 July 2017). Patients with severe anaemia (defined as haemoglobin < 7 g/dl) at any time during their hospital stay were included. Among those with severe anaemia, patients who underwent sickling testing (i.e. Emmel test) [9] for suspected SCD were further analysed. Case notes were reviewed by two separate reviewers and an Excel spreadsheet was used to collate and analyse the data.

## RESULTS

From February to July, a total of 753 paediatric patients were admitted to the district hospital, 273 of whom suffered from severe anaemia during their hospital stay. All of these patients had rapid diagnostic test done for *P. falciparum* using SD BIOLINE malaria Ag Pf. (HRP-II)<sup>TM</sup>, of which 253 (92.7%) were positive and received treatment for malaria. Emmel test was done in 24.5% (n=67) of children with severe anaemia, among whom 34.3% (n=23) tested positive. For those with a positive Emmel test, 47% received a prescription for folic acid and 17% received penicillin prophylaxis on discharge. The breakdown of these patients is shown in Figs 1 and 2.

## DISCUSSION

SCD is a condition that can present in many different ways and at various stages of childhood. Disease severity ranges from mild chronic anaemia to acute severe infections or stroke. Due to its heterogeneous nature, healthcare professionals in areas where there are no national screening programmes should maintain a high level of suspicion to prompt testing. Methods such as haemoglobin electrophoresis, iso-electric focusing and high-performance liquid chromatography (HPLC) are used for diagnosis confirmation [3], but are not widely available in HRLS where Emmel-type testing may be the only option. Its main disadvantage is that a positive result does not distinguish between the trait and the disease, and therefore potentially results in over-diagnosis of the condition.

In this case series, we identified a group of anaemic paediatric patients with positive Emmel tests and therefore possible SCD. In a region with stable malaria transmission, cases of severe anaemia are often attributed to malaria and thus, unless there are other signs of SCD, testing may not be undertaken. Sickle cell trait confers protection against malaria, favouring survival and transmission of the sickle cell gene, which explains its high frequency in malaria endemic regions [10]. Our case series raises the question of whether many cases of SCD in children are

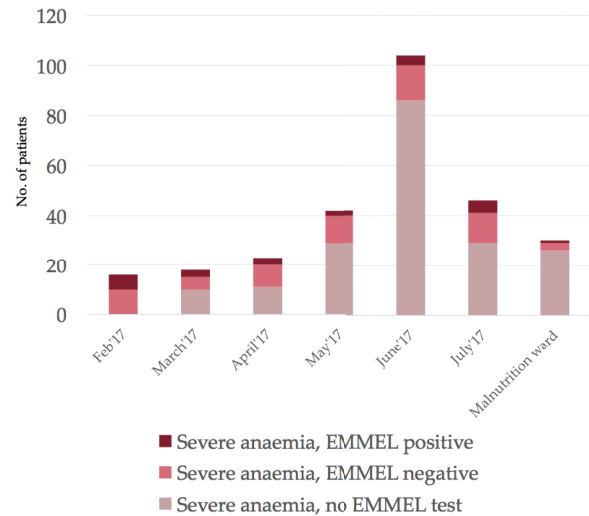


Figure 2: Patients with severe anaemia and Emmel testing results.

being missed since overlapping of symptoms may lead to under-recognition of the haemoglobinopathy. In addition, as the Emmel test cannot differentiate between a heterozygous carrier and a homozygous patient, it highlights a significant diagnostic problem in HRLS where definitive haemoglobin-based diagnostic techniques (which involve expensive equipment, ongoing supply costs and trained personnel) [11] are lacking. Newborn screening has contributed to decreased child mortality in high resource countries [8]; however, its implementation in sub-Saharan Africa may be limited due to economic constraints. As a result, further research is required into the development of an accurate and affordable point of care test that can identify homozygous patients such as sickle SCAN<sup>®</sup>, which showed excellent sensitivity and specificity when evaluated against existing gold standards [12]. As rapid diagnostic testing has changed the way malaria is diagnosed, similarly SCD as a WHO priority condition, it requires a rapid diagnostic test of a similar standard.

Despite its disadvantages, it can be argued that a positive Emmel test in a patient with clinical manifestations of SCD should be sufficient to start prophylactic measures to reduce long-term morbidity in areas where it is the only technique available. Our study shows that the provision of prophylactic measures, such as folic acid and antibiotic prophylaxis, to patients with suspected SCD was neither sufficient nor consistent. This can be explained by the lack of education among healthcare workers in settings where there is no formal SCD follow-up programme.

Our report has several limitations. First, data was collected retrospectively and therefore information gathering relied on the accuracy of clinical notes. Also, given the hospital was

supported by an international non-governmental organization at the time of data collection, the figures cannot be assumed to reflect practices in unsupported government hospitals or throughout the region.

SCD is a severe health condition associated with high mortality and morbidity in sub-Saharan African HRLS. Educating healthcare workers and caregivers, reliable point of care testing and prophylactic measures together with patient follow-up are all required to reduce SCD mortality and improve patients' quality of life.

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## CONFLICT OF INTEREST STATEMENT

None declared.

## FUNDING

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## ETHICAL APPROVAL

Not required.

## INFORMED CONSENT

Not required.

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