ORIGINAL ARTICLE

Epidemiology of Sickle Cell Disease in Grenada: A comparison with Haiti, Jamaica and the United States of America

M Nalbandian[1], H Kaminsky[1], P Baghdasaryan[1], D Keleny[1], K Nalbandyan[2], TO Jalonen[1]

ABSTRACT

Objective: *Sickle cell disease (SCD) is a multifaceted, chronic disease severely affecting the quality of life of patients and their families. In addition, it is becoming a costly public health concern. In comparing the epidemiology, management and outcome of SCD in the United States of America and the Caribbean, this article aimed to promote awareness of SCD and the need for adequate treatment.*

Methods: *The surveillance data for SCD patients in Grenada were collected from the General Hospital of Grenada (St George's, Grenada) from discharge sheets that were filled out with the diagnosis of the patient and the cause of death. The data included the number of patients with SCD admitted to the hospital from 2007 to 2013, along with the number of individuals with SCD who died during each year.*

Results: *Based on the given data, the average prevalence of SCD was approximately 1.49 per 1000 persons per year. The average case-fatality rate was 1.10%, and the average cause-specific mortality rate was 1.64 per 100 000 persons per year.*

Conclusion: *The lack of continuous registered follow-up of patients with SCD and the lack of preventive care, especially in developing countries, still results in the early deaths of patients. The data validated the severity of SCD in Grenada, and were compared with the data available in Haiti and Jamaica, in order to stress the importance of implementing better follow-up care to decrease the incidence and mortality of this devastating disease. Proper data collection and guidelines for basic care are needed to improve the quality of life of the patients with SCD in Grenada and the rest of the Caribbean region.*

Keywords: Caribbean, epidemiology, Grenada, sickle cell disease, United States of America

Epidemiología de la enfermedad de células falciformes en Granada: Una comparación con Haití, Jamaica y los Estados Unidos de América

M Nalbandian[1], H Kaminsky[1], P Baghdasaryan[1], D Keleny[1], K Nalbandyan[2], TO Jalonen[1]

RESUMEN

Objetivo: *La enfermedad de células falciformes (ECF) es una enfermedad multifacética, crónica que afecta gravemente la calidad de vida de los pacientes y sus familias. Además de ello, esta enfermedad se está convirtiendo en un costoso problema de salud pública. Al comparar la epidemiología, el manejo, y los resultados de la ECF en los Estados Unidos de América*

From: [1]Department of Physiology and Neuroscience, St George's University School of Medicine, University Centre, St George's, Grenada, West Indies and [2]Western University of Health Sciences, Pomona, California, United States of America.

Correspondence: Ms M Nalbandian, Department of Physiology and Neuroscience, St George's University School of Medicine, University Centre, St George's, Grenada, West Indies. Email: mnalband@sgu.edu

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y el Caribe, este artículo persigue promover una mayor conciencia sobre la ECF y la necesidad de un tratamiento adecuado.
Métodos: *Se recolectaron los datos de vigilancia de los pacientes de ECF del Hospital General de Granada (San Jorge, Granada) a partir de las hojas de alta en las que se consignaban el diagnóstico del paciente y las causas de muerte. Los datos incluían el número de pacientes con ECF ingresados en el hospital entre 2007 y 2013, junto con el número de personas con ECF que murieron durante ese período.*
Resultados: *Sobre la base de los datos obtenidos, la prevalencia promedio de ECF fue aproximadamente 1.49 por cada 1000 personas por año. La tasa de letalidad promedio fue de 1.10%, y la tasa de mortalidad promedio por causas específicas fue de 1.64 por cada 100 000 personas por año.*
Conclusión: *La falta de registro de seguimiento continuo de pacientes con ECF y la falta de atención preventiva, especialmente en los países en desarrollo, trajo como consecuencia la muerte temprana de pacientes. Los datos validaron la severidad de la ECF en Granada, y se compararon con los datos disponibles en Haití y Jamaica, con el fin de subrayar la importancia de implementar una mejor atención al seguimiento y disminuir así la incidencia y mortalidad de esta devastadora enfermedad. Se necesita una recogida adecuada de datos, así como guías para la atención básica, a fin de mejorar la calidad de vida de los pacientes con ECF en Granada y el resto de la región del Caribe.*

Palabras clave: Caribe, epidemiología, Granada, enfermedad de células falciformes, Estados Unidos de América

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INTRODUCTION

Sickle cell disease (SCD) is an inherited life-threatening condition, which significantly affects the quality of life of patients globally. In both the United States of America (USA) and the Caribbean region, the disease is most prevalent among persons of African origin. As in other Caribbean countries, it is surmised to be present as a trait in about 10% of the population, although in Grenada the real prevalence of both SCD and its trait is unknown.

Sickle cell disease is a haemoglobinopathy of red blood cells (RBCs) that is characterized by painful episodes of vaso-occlusion caused by micro-infarcts and haemolysis. In most cases, the disease is caused by a single-gene mutation of the beta-globin gene. The resulting haemoglobin (HbS) polymerizes with other HbS molecules during states of stress or low oxygen, which transforms the red blood cell into a crescent or sickle shape. As a result, these cells have increased adhesion to the endothelium and decreased ability to manoeuvre through small vessels, which can lead to vaso-occlusion. The sickled RBCs have a shorter lifespan, which results in a shortage of RBCs leading to anaemia (1).

Pain is the main hallmark of SCD, and for most of these patients, 'the pain is their nemesis, their unpredictable master, and ruthless dictator' (2). In a recent study conducted in Grenada, the pain was shown to disrupt significantly individuals' daily activities, mood, work and sleep, which impinges on their overall quality of life. The study stressed the importance of managing pain effectively, since 41% of the participants noted that the prescription medications they had been receiving were ineffective (3). The prevalence and incidence of SCD or its trait in Grenada are unavailable. This article seeks to update the SCD census in Grenada for the at-risk population in order to shed light on the need for advancing screening of SCD and its trait. Doing so will help to increase education and improve management of this deadly disease. This would not only increase the lifespan of the patients but also decrease the incidence of the disease as well.

SUBJECTS AND METHODS

This study is part of a wider study on the general awareness of the background and symptoms of SCD (St George's University Institutional Review Board approval #14074), and the pain that persons with SCD experience (St George's University Institutional Review Board approval #14020). The surveillance data for Grenada were collected from the General Hospital of Grenada (St George's, Grenada), one of the two public

hospitals in Grenada (excluding Carriacou and Petite Martinique). Information was collected from the hospital discharge sheets with the diagnosis of the patient and reported cause of death. The data included the number of patients with SCD admitted to the hospital between 2007 and 2013, along with the number of individuals with SCD who died during each year. The prevalence data were for all types of SCD, including SS, SC and CC subtypes. The statistical analysis of patients admitted to the hospital per year was done by comparing it to the total population of Grenada during that year by utilizing the World Bank data tabulation method (4). Statistical analysis was conducted using Microsoft Excel version 15.13.1 (150807), a computer application that provides in-depth data access for analytical reporting.

RESULTS

Tables 1 and 2 show the prevalence of SCD in Grenada based on in-hospital deaths and hospital discharges from 2007 to 2013. The average number of patients with SCD discharged from the General Hospital of Grenada every year was 156 patients, with a standard deviation of 10.3 and with an equal number of male and female patients. The average prevalence of patients with SCD discharged from this hospital compared to the total population of Grenada was 1.49 per 1000 persons per year. The average case-fatality rate (CFR) from 2007 to 2013 was 1.10%, and the average CFR was 1.15% in male patients and 1.16% in female patients. The average crude death rate tabulations in Grenada between 2007 and 2013 were 7.7 deaths per 1000 persons per year (4). According to

Table 1: General epidemiology of sickle cell disease in Grenada, 2007–13

	A	B	C	D	E	F
Males (2007)	62		1	1.61		
Females (2007)	82		0	0.00		
Total (2007)	**144**	**1.39**	**1**	**0.69**	**103 586**	**0.97**
Males (2008)	79		1	1.27		
Females (2008)	84		0	0.00		
Total (2008)	**163**	**1.57**	**1**	**0.61**	**103 932**	**0.96**
Males (2009)	68		1	1.47		
Females (2009)	75		1	1.33		
Total (2009)	**143**	**1.37**	**2**	**1.40**	**104 296**	**1.92**
Males (2010)	82		1	1.22		
Females (2010)	83		1	1.20		
Total (2010)	**172**	**1.64**	**2**	**1.16**	**104 677**	**1.91**
Males (2011)	91		1	1.10		
Females (2011)	68		2	2.94		
Total (2011)	**159**	**1.51**	**3**	**1.89**	**105 074**	**2.86**
Males (2012)	91		0	0.00		
Females (2012)	68		1	1.47		
Total (2012)	**159**	**1.51**	**1**	**0.63**	**105 483**	**0.95**
Males (2013)	71		1	1.41		
Females (2013)	83		1	1.20		
Total (2013)	**154**	**1.45**	**2**	**1.30**	**105 897**	**1.89**

Column A: the number of patients with SCD discharged from the General Hospital of Grenada each year from 2007 to 2013.

Column B: the prevalence of SCD in Grenada according to the hospital indicating the number of discharged patients with SCD compared to the general population in Grenada.

Column C: the number of SCD deaths that occurred in this hospital.

Column D: the CFR indicating the number of deaths attributable to SCD in this hospital over the number of individuals with SCD discharged.

Column E: the general population size in Grenada during that specific year.

Column F: the cause-specific mortality rate, which is the number of SCD deaths from the hospital over the general population.

the General Hospital of Grenada, the average cause-specific mortality rate (years 2007–13) of SCD was 1.64 deaths per 100 000 persons per year. This information indicates that deaths due to SCD may be responsible for approximately 0.21% of deaths that occur in Grenada.

Table 2: Summary of epidemiological data of sickle cell disease, 2007–13

Total number of deaths	12
Total number of deaths in females	6
Total number of deaths in males	6
Average prevalence per 1000 persons per year	1.49
Average cause-specific mortality rate per 100 000 persons per year	1.64
Average CFR	1.10%
Average CFR in females	1.16%
Average CFR in males	1.15%

DISCUSSION

A sickle cell pain crisis is the most common symptom affecting patients with SCD, and a frequent cause of hospitalization and emergency department visits (2). Persistent, severe pain is a poor prognostic sign and a high predictor of death. The available data, which shows that the number of deaths attributable to SCD is approximately 0.21% of the total deaths per year in Grenada, indicates a need for improvement in preventive care measures. During a 10-year study in the USA in 1999–2009, African Americans with SCD had an age-adjusted mortality rate of 1.3 per 100 000 African Americans (5). The prevalence and mortality rates of SCD in Grenada were under-represented because the data were obtained only from the General Hospital of Grenada, but this value (1.64 deaths per 100 000 persons per year) was still higher than the one reported in the USA. Due to the high rate of deaths attributable to SCD, this article stresses the dire need to improve the management of the complications that arise from SCD, in addition to decreasing the overall incidence of SCD by improving public awareness and knowledge of the disease. Further, the preliminary data from the General Hospital of Grenada, showing a high prevalence of SCD, conveys the need for additional studies to be conducted in order to determine the actual prevalence and incidence rates of the entire population.

Life expectancy

Patients with SCD have a much better prognosis in the USA than in developing countries. However, even with up-to-date treatment measures, the median life expectancy is still at least 20 years less than the average survival of the general population (6). Ferster noted that in the USA, the median age of death for men with SCD was 42 years, and for women 48 years (7). In the USA, the life expectancy has increased significantly because of improvements in newborn screening, parental and healthcare providers' education, and options for preventive treatment together with continuous pain management to avoid crisis. Based on two previous reports, in the USA, 93.9% of patients with SCD reached 18 years of age (8, 9).

Epidemiology in the United States of America and the Caribbean

According to the National Newborn Screening and Global Resource Center (10), SCD affects 90 000 to 100 000 Americans, and one in 500 African-American newborns has SCD. In addition, one in 13 African Americans are carriers (has the trait for SCD). The overall incidence rate for SCD has been shown to be 1:3044 (Hb SS), 1:7386 (Hb SC) and 1:2474 (HbSS/SC) births in the USA. According to a birth-cohort disease prevalence, the number of individuals with SCD has been shown to be around 104 000 to 138 900 (11).

A study conducted in Haiti in 2010 (12), analysing 1035 healthy Haitian subjects, demonstrated that the prevalence of a sickled HbS (the sum of individuals with trait or disease) was 15.1%. During the Jamaica Cohort Study (13), 10 000 screenings of non-operative deliveries concluded that approximately 10.0% of the newborns had the sickle cell trait and one in 300 births had SCD. The same study also concluded that the rates of SCD had not declined in the past 22 years. Other studies have postulated no decline in 47 years (14, 15). This demonstrates the need for increased guidance and family planning in areas of high SCD prevalence. In a screening study conducted in the USA, the mortality of infants who were diagnosed with SCD as newborns was 1.8%, compared to 8% among the infants who were diagnosed only after three months (16). Hence, it urges the need for newborn screening and early educational interventions during pregnancy to improve survival, diagnosis and treatment in the Caribbean.

Management of sickle cell disease and causes of death

Although SCD is a fatal disorder when treated inadequately, current treatment therapies can greatly extend the life expectancy by reducing the number of painful vaso-occlusive crises and life-threatening infections (17). Patients with SCD suffer severe, often continuous, physiological pain in the form of neuropathic and referred

pain. Therefore, the best pain management technique should stress the importance of individually targeted, age-dependent pain management programmes from birth to adulthood (18). Early and aggressive treatment of acute pain can reduce the likelihood of development of chronic pain. Chronic pain is often correlated with other morbidities, such as depression, anxiety, despair, insomnia, loneliness, helplessness and dependence on opioid pain medication (19).

During an acute crisis, patients in Grenada are often treated with an injection of analgesics in the emergency room and sent home. This type of treatment provides only temporary relief, and re-admittance rates due to acute crises remain high. In more developed countries, such as in the USA, moderate and strong chronic pain is often treated with short acting opioids in between hospital admissions to keep the patient continuously free of pain and related crises (20). Adequate treatment protocols include immunizations and prophylactic antibiotics against infection, together with hydroxyurea and blood transfusion to help prevent crises. Bone marrow and stem cell transplants have become available as the only curative therapy and have been found to be successful in some individuals in the USA (17).

The data from the USA showed that the primary cause of death before adulthood in patients with SCD was pneumococcal sepsis. During adulthood, 75% of the patients died during a crisis or acute chest syndrome. Of these patients, 33% were generally otherwise healthy and died during a crisis with no obvious organ failure (21). More recently, it has been reported that 63.3% of deaths are attributable to acute events, which include painful crisis (59%), painful crisis along with acute chest syndrome (12.0%), acute chest syndrome (5.4%), splenic sequestration crisis (6.0%) and acute massive haemolysis along with painful crisis [9.0%] (22). This kind of detailed information is not available in Grenada. Experiencing excruciating pain during a sickle cell crisis has a significant effect on mortality. Hence, preventing crises can improve the lifespan of patients with SCD.

CONCLUSION

Sickle cell disease has become a global concern due to the continuous suffering endured by these patients and the increasing burden on the individual and the national economy. The genetic background, chronic nature, and existence of life-threatening periods of stress-induced crises display the clinical importance of this disease. There is an urgent need to discover methods to improve the quality of care for these patients while lowering the incidence of SCD. Based on the available information, it is clear that neither the awareness nor the treatment regimens available in Grenada were at the level available in the USA or even in some other Caribbean countries. Hence, efforts need to be made to decrease the prevalence of SCD in Grenada, along with implementing effective treatment strategies, in order to improve the quality of life of patients with SCD.

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