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BRIEF COMMUNICATION

Laparoscopic Sleeve Gastrectomy in Sickle Cell Disease: a Case Series

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Abstract

With improved care, the number of sickle cell patients with obesity is increasing. The experience with bariatric surgery in this patient population is limited. We describe four adult patients with mild sickling genotypes who underwent laparoscopic sleeve gastrectomy. The patients achieved marked weight loss with percentage of excess weight loss ranging from 56 to 68%. The surgery was associated with decreases in white blood cell counts and lower random glucose concentrations. No short-term or long-term complications related to the surgery were observed. Our report supports bariatric surgery as a feasible weight-loss option in this patient population.

Keywords Sickle cell disease · Bariatric surgery · Glucose · White blood cell

Introduction

Obesity, a major health issue in the USA, is associated with increased cardiovascular risk and with comorbidities such as diabetes mellitus and hypertension [1]. Patients with sickle cell disease (SCD), particularly those with the hemoglobin (Hb) SS or HbSβ^0-thalassemia genotype, tend to be underweight, likely due to increased basal energy expenditure to compensate for hemolysis and poor nutritional intake during painful vaso-occlusive crisis [2]. Recent reports show that 20–50% of SCD patients are overweight, usually among those with the Hb SC or Hb Sβ^+-thalassemia genotypes who have less hemolysis and ineffective erythropoiesis [3]. Bariatric surgery is an effective approach to treat obesity and ameliorate obesity-related comorbidities [1], but experience with this procedure in patients with SCD is limited. A recent study based on an administrative health database demonstrated that bariatric surgery was not associated with increased risk of complications in SCD and that it decreased the risk of vaso-occlusive crises (VOC) [4]. Detailed clinical information before and after the bariatric surgery was not available in that study due to the nature of the data source. Here, we report four SCD patients who underwent bariatric surgeries and achieved marked weight loss without experiencing significant complications.

Case Series

This is a retrospective case series of four adult patients with SCD who had bariatric surgeries performed at the University of Illinois at Chicago (UIC), a single academic center, between 2013 and 2016. Patient demographics and characteristics are provided in Table 1. All four patients were females; two with the Hb SC genotype and two with the Hb Sβ^+-thalassemia genotype. Prior to bariatric surgery, the body mass index (BMI) ranged from 37.8 to 47.1 kg/m^2 and obesity-related comorbidities included obstructive sleep apnea (OSA), hypertension, and pulmonary arterial hypertension. The type of bariatric surgeries for all four patients was laparoscopic sleeve gastrectomy performed under general anesthesia. All four patients had a baseline Hb concentration > 10 g/dL and did not receive pre-operative blood transfusion. No peri-operative blood transfusions were required and no acute surgery-related complications occurred. Twelve months after the surgery, all four patients experienced marked weight loss with percentage of excess weight loss (%EWL) ranging from 56 to 68%. Random glucose levels and white blood cell (WBC) counts decreased in all four patients after the surgery (Table 1). Three of the patients were prescribed vitamin B supplements prophylactically after the surgery as part of a standard supplementation protocol and the other patient took a multivitamin. The

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Table 1 Patient baseline characteristics and clinical changes after bariatric surgery

	Patient 1	Patient 2	Patient 3	Patient 4
Age	42	23	26	41
Gender	Female	Female	Female	Female
Genotype	Hb SC	Hb Sβ^+	Hb Sβ^+	Hb SC
Obesity-related comorbidities	OSA, HTN	OSA, PAH, acid reflux	OSA, HTN	HTN
Pre-surgery weight (kg)	119	100	117	120
BMI (kg/m^2)				
Pre-surgery	41.9	37.2	47.2	40.7
Post-surgery	30.9	30.3	33.3	29.1
Glucose level (mg/dL)				
Pre-surgery	94	117	96	106
Post-surgery	69	71	89	78
WBC (10^3/uL)				
Pre-surgery	13.8	8.0	7.7	6.7
Post-surgery	11.6	6.7	5.3	4.6

OSA, obstructive sleep apnea; *HTN*, hypertension; *PAH*, pulmonary arterial hypertension

The body mass index (BMI), random glucose levels, and white blood cell (WBC) counts were an average of three results on separate occasions

hemoglobin concentrations ranged from 10.9 to 12.3 g/dL in the four patients before the surgery, and the concentrations were similar 1 year after the surgery (11.3–11.7 g/dL). Vitamin D levels (20–38 vs. 17–35 ng/mL) and mean corpuscular volume (MCV) (71–107 vs. 71–133 fL) were also comparable before and after the surgery. No substantial reductions were observed in vitamin B_{12}, folate, or iron levels after 1 year. There was no change with the pain management regimen before and after the surgery, and the frequency of vaso-occlusive pain crises requiring medical attention during the 12 months before the surgery (0, 0, 1, and 30 for the four patients presented here) was comparable to that in the 12 months after the surgery (0, 0, 2, and 30, respectively).

Discussion

Although the prevalence of metabolic diseases, such as diabetes mellitus, is generally low with SCD, it significantly increases with obesity and age, especially in patients with the HbSC or HbSβ^+-thalassemia genotypes [5]. Besides increasing the risk of developing cardiovascular diseases, obesity may also worsen obstructive sleep apnea (OSA) and nighttime hypoxia in SCD [6]. Therefore, bariatric surgery may have a role in managing overweight and obesity in this patient population. The patients presented here did not experience significant short-term or long-term complications after the bariatric surgery while achieving 56–68% EWL 1 year after laparoscopic sleeve gastrectomy. As an immunocompromised condition, patients with SCD are at higher risk for infections; therefore, post-operative monitoring for signs and symptoms of infection is important for this patient population. Excess blood loss or general anesthesia associated with the surgery may trigger VOC and other sickle cell complications, and patients with pre-operative low hemoglobin levels may need blood transfusion during the peri-operative period. Laparoscopic sleeve gastrectomy is not usually associated with malabsorption of vitamins and irons [1], and none of the four patients exhibited vitamin deficiency or worsening anemia 1 year after the surgery. Due to the low hemoglobin levels associated with SCD, B_{12}, folate, and iron levels need to be closely monitored after the surgery in this patient population, and supplementation should be provided when necessary. There is evidence that chronic opioid users may have increased requirements for opioids after bariatric surgery [7], but the frequency of pain crisis was comparable in the four patients presented here despite the same pain regimen. The reduction of random glucose levels in all four patients may represent improvement in the metabolic profile, although the presented patients did not have pre-existing diabetes mellitus and the pre- and post-operative random glucose levels were within normal range. Hemoglobin A1c test may not reflect the blood glucose levels in SCD due to the shortened red blood cell life span, and fructosamine or fasting glucose levels may be a more appropriate test to use in patients with SCD.

SCD is considered a chronic inflammatory condition. It has been shown that elevated neutrophil counts positively correlate with more severe clinical manifestations [8]. Obesity is also associated with chronic, systemic inflammation [9], which may worsen complications in SCD. There is evidence that bariatric surgery leads to an improvement in the inflammatory profile in patients with obesity [10], and this is consistent with the observed reduction of the WBC counts in all four patients here. The decreased inflammation may provide long-term benefits to this patient population, in addition to the metabolic and cardiovascular benefits. Hydroxyurea also has anti-

inflammatory and myelosuppressive effects. For patients who are taking hydroxyurea, neutrophil counts need to be monitored closely to avoid side effects such as neutropenia. One of the four patients here was treated with hydroxyurea therapy before and after the bariatric surgery. Her neutrophil count was 5700/uL pre-operatively and the nadir was 1800/uL 1 year after the surgery while on a stable dose of hydroxyurea.

A recent study showed no association between bariatric surgery and increased complications in SCD [4], which is similar to our findings. The same study demonstrated bariatric surgery reduced risk of VOC and shorter length of hospitalization stay. Although our results did not show decreased incidence of VOC after bariatric surgery, likely due to the small sample size, the reduction in WBC counts and inflammation that we observed may partially explain the decreased complications and hospitalizations in the previous study. All four patients presented here have either HbSC or HbSβ^+ genotype, and they represent a subtype of SCD patients with less severe disease compared with HbSS or HbSβ0 genotype, which may also explain the fewer hospitalizations in the patients undergoing bariatric surgery observed in the previous study [4]. Future studies should evaluate more sensitive inflammatory markers, such as c reactive protein and the long-term effects of bariatric surgery on obesity-related comorbidities in SCD patients with obesity.

This report is limited by the small sample size and by the lack of some metabolic profile tests due to its retrospective nature. Nevertheless, we found that bariatric surgery helped achieve marked weight loss in patients with SCD and that it was not associated with short-term or long-term complications. Bariatric surgery may also provide some anti-inflammatory benefits, in addition to improving the metabolic profile.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval Statement This study was reviewed and granted exempt status by UIC Institutional Review Board. As this is a retrospective study, for this kind of study, formal consent is not required.

Informed Consent Does not apply to this retrospective study.

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