

Perioperative transfusion of patients with sickle cell disease undergoing surgery at the University Hospital of the West Indies (UHWI).

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Abstract

A one-year retrospective analysis was done to identify the perioperative transfusion practice in patients with all genotypes of sickle cell disease at the University Hospital of the West Indies (UHWI) and their postoperative complication rates. Twenty-nine patients who had 32 procedures were included. Most patients (23) were homozygous SS. The most common procedure was splenectomy, accounting for 34.4%. The mean steady state haemoglobin level was 8.1 ± 1.4 g/dl and 56% of patients had a haemoglobin level at surgery which was below their steady state. The perioperative transfusion rate was 34%. Main indications were symptomatic anaemia and significant blood loss. Nine patients (31%) had at least one postoperative complication. A selective transfusion approach in sickle cell patients, based on haemoglobin concentration relative to steady state and clinical status, was practiced at the UHWI. This approach did not appear to increase the incidence of postoperative complications.

INTRODUCTION

Patients with sickle cell disease (SCD) form a unique group with special perioperative needs. The risk of postoperative complications is higher than in non-sickle cell disease patients (1-3), and this is related to their anaemia, sequestration crises, acute chest syndrome, poor wound healing and higher wound infection rates. Some clinicians have advocated the use of preoperative transfusions (exchange or simple) to reduce the concentration of haemoglobin S and therefore to decrease the risk of complications (4-7). Others have recommended that routine preoperative transfusion be considered only if the patient is significantly below their steady-state haemoglobin level (8-10).

In 1979, a review conducted at the UHWI by Homi et al (9) recommended a selective transfusion approach, stating that even major surgery could be accomplished at steady state haemoglobin concentrations without harm to the patient. This approach had the added benefit of decreasing transfusion-related complications, such as alloimmunization and iron overload. Similar views have been expressed by Browne in 1965 (7) and Buck in 2005 (2, 8). However, other

studies have suggested that complication rates could be significantly reduced using a preoperative transfusion protocol (11, 12).

In 1995 Vichinsky et al (7) compared two approaches to transfusion (conservative and aggressive) in haemoglobin S patients. This study is frequently cited (34 English language articles) and appears to be highly influential in current practice (2, 6). In the conservative approach, the patient was transfused to 10g/dl preoperatively disregarding the percentage of haemoglobin S. In the aggressive approach, the percentage of haemoglobin S was reduced to 30% or less and the haemoglobin level corrected to at least 10g/dl. Vichinsky et al (7) concluded that the conservative is as effective as the aggressive approach and reduces transfusion-associated complications.

At the UHWI, more recent local studies show that we continue to follow Homi's selective approach to transfusion. (13-16). These have been retrospective studies on specific groups of surgical patients, such as those undergoing cholecystectomy or splenectomy. This study was designed to examine all surgical patients with sickle cell disease over a one-year period. The objectives were to determine the

frequency of perioperative transfusions, the factors affecting transfusion practice (with specific reference to steady state haemoglobin) and the incidence of post-operative complications.

METHODOLOGY

Data were collected from patients’ dockets retrospectively. Patients were identified from a data bank created to assess postoperative complications for all patients undergoing surgery in the main operating theatre at UHWI between March 1st 2004 and February 28th 2005. Private and obstetric patients were excluded.

Demographic data, as well as information related to the surgery performed, blood loss and transfusion requirements pre-, intra- and postoperatively were collected. Data related to assessment of their chronic status (SCD) as well of their acute status (pathology requiring operation) were also collected. Indices of chronic disease included previous sickle cell complications, number of previous admissions, and their transfusion history. A steady-state haemoglobin level was recorded for all patients 4 years old and over. In patients younger than four, their “last well” haemoglobin level was considered to be their steady state. Indices of their acute status included American Society of Anaesthetists (ASA) status, current haemoglobin level, any current sequestration or infections, and any current evidence of organ dysfunction (hypoxia, chest infiltrates, abnormal liver function or creatinine levels). Postoperative complications (up to hospital discharge) were recorded, using definitions from Wright et al (17) (Table 1). The data were collated using the EpiData computer programme and analysed using STATA SE version 10.

Ethical approval was obtained from the Ethics Committee, Faculty of Medical Sciences, University of the West Indies.

Figure 1

Table 1: Definitions of sickle cell complications (Wright et al, 1999)

Complication	Definition
Bacteraemia	Febrile illness associated with positive blood culture
Painful crisis	Bone pain requiring parenteral narcotic analgesia
Acute chest syndrome	Radiological confirmation of new pulmonary infiltrates or signs of consolidation associated with cough and dyspnoea
Febrile episode	Fever >38.5°C without identifiable cause
Acute Splenic sequestration	Increase in splenic size, fall in Hb, increase in reticulocytes, responding to transfusion or spontaneously resolving.

RESULTS

A total of twenty-nine patients who had 32 procedures were retrieved from the data bank. There were 14 males and 15 females (Table 2). Their ages ranged between fifteen months and 51 years, with a mean age of 22 years, mode 4 years and median 17.5 years (Fig 1). The majority of patients had sickle cell anaemia, HbSS (23 patients). The remainder included one patient with sickle haemoglobin C disease (HbSC), one with sickle ̢thalassaemia (S̢0) and four with sickle ̢+thalassaemia.(S̢+). The majority of patients (72%) had multiple (2 or more) prior admissions and had received previous transfusions (52%) (Table 2). Twenty-six of the procedures (81.2%) were done under general anaesthesia and six under a regional technique (18.8%). The most common surgical procedure done was splenectomy, accounting for 34.4% (11 procedures) (Table 3).

Figure 2

Figure 1: Age distribution

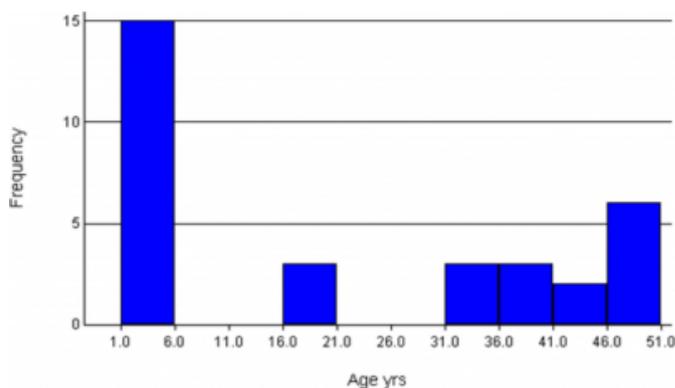


Figure 3

Table 2: Distribution of patient characteristics

Variables	Children N=15	Adults N=14	All N=29
Gender (Male: female)	(11,4)	(3,11)	14,15
Genotype (SS:others)	12 : 3	11 : 3	23 : 6
Mean Steady State Hb	8.3±1.1 (min 6.5, max 11.2)	7.9±1.4 (min 6.0 max 11.5)	8.1±1.3 (min 6.0, max 11.5)
Median no of previous transfusions (min, max)	0 (0,3)	1(0,8)	1 (0,8)
Median no of previous admissions (min, max)	2(0,10)	5(0,20)	3 (0,20)

Figure 4

Table 3: Distribution of anaesthetic techniques and surgical procedures

Variables	Children N=15	Adults N=17	All N=32
Anaesthetic technique (GA:Regional)	(15:0)	(11:6)	(26:6)
Surgery			
Splenectomy	10	1	11 (34.4%)
Laparotomy	0	3	3 (9.4%)
Hip replacement	0	2	2 (6.3%)
Osteomyelitis debridement	0	2	2 (6.3%)
Incision & Drainage	1	1	2 (6.3%)
Leg Ulcer debridement/skin grafting		1	1 (3.1%)
Cholecystectomy/CBD exploration laparoscopic	0	1	1 (3.1%)
Other	4	6	10(31.3%)

The mean steady state haemoglobin level was 8.1 ± 1.4 g/dl (Table 2). The current haemoglobin levels ranged between 5.3 and 11.9 g/dl (mean 7.8 ± 1.6), with 15 (52%) having levels below their steady state. Ten patients had an ongoing infection at the time of the procedure, two had a current painful crisis and one patient had ongoing splenic sequestration.

With regards to perioperative transfusion, only ten patients were transfused (34%). Of these patients, five were below their steady state haemoglobin and five were above. The mean steady state of the transfused group was 7.6 ± 0.7 g/dl, and 8.3 ± 1.4 g/dl for the non-transfused group (Table 4). The difference between steady-state and current haemoglobin ranged from -1.9 to 1.8 g/dl for the transfused group and -1.9 to 0.7 g/dl for the non-transfused group. One patient received multiple transfusions, resulting in twelve transfusions in total. Three were transfused preoperatively (10.3%), all indicated because of symptomatic anaemia. The four intra-operative transfusions were performed because of significant blood loss, and one of these patients became haemodynamically unstable. Five postoperative transfusions were given because of symptomatic anaemia.

Figure 5

Table 4: Patient characteristics and complication rates in transfused and non-transfused groups

Variables	Not transfused N=19	Transfused	
		Steady state >current Hb N=5	Steady state \leq current N=5
Age group			
<12 years	12	2	1
\geq 12 years	7	3	4
Gender Male	10	1	3
Female	9	4	2
Mean Steady state haemoglobin g/dl	8.3 ± 1.4	7.6 ± 0.4	7.6 ± 0.7
Mean difference in haemoglobin g/dl	-0.3 ± 0.8	-1.2 ± 0.4	0.9 ± 0.8
Complications			
No	15	1	4
Yes	4	4	1

Nine patients (31%) had at least one documented post-operative complication and 5 of these were transfused (Table 5). The most common non-specific sickle cell complications were wound infections and febrile episodes, seen following 3 procedures respectively. One patient, who had multiple procedures following a perforated gastric ulcer, developed several complications including a febrile episode, lower respiratory tract infection and wound infection. With regards to sickle-specific complications, there were 5 episodes of acute chest syndrome (ACS) and one case of presumed ACS a rate of 20.7% of which 50% were transfused postoperatively. All of these patients had upper abdominal surgery (four splenectomies, one laparotomy and one cholecystectomy). None of these patients required intensive care and there were no mortalities. Of the nineteen patients who were not transfused, four developed postoperative complications (21%).

Figure 6

Table 5: Complications seen in patients with SCD

Patient number	Transfused?	Time of Transfusion	Procedure	Complications
6	Yes	Pre, intra, post-op	Laparotomy	Wound infection, LRTI, febrile episode
9	No	N/A	Splenectomy	Presumed ACS
10	No	N/A	Splenectomy	ACS
11	Yes	Intra-op	Hip replacement	Febrile episode
12	No	N/A	Splenectomy	ACS and febrile episode
14	No	N/A	Skin grafting	Wound infection
16	Yes	Post-op	Laparotomy	ACS
25	Yes	Post-op	Cholecystectomy	ACS, wound infection
29	Yes	Post-op	Splenectomy	ACS

DISCUSSION

In this review of sickle cell patients undergoing surgery at the UHWI, haemoglobin levels at the time of the procedure were related to steady-state haemoglobin levels and correlated with transfusion practice and outcome. The findings have supported the observation that a selective approach to perioperative transfusion is being practiced by anaesthetists and surgeons at this institution, as recommended by Homi et al (9). Our transfusion rate was 34%, and the major indications were symptomatic anaemia and significant blood loss. No routine preoperative transfusions to increase patients' haemoglobin levels above steady state or decrease HbS concentration were done. The decision to transfuse was based on clinical indications and not on haemoglobin concentration. This approach was even applied to patients whose haemoglobin levels were as much as 1.9 g/dl below their steady state.

Our overall complication rate was 31%, with 20.7% being sickle-related. Four patients in the non-transfused group had complications (21%). Five patients in the transfused group had complications, a rate of 50%. Of these five patients, four had a preoperative haemoglobin level below their steady state, supporting the opinion that such patients should be transfused prophylactically. The higher complication rate among transfused patients may reflect the fact that these patients were more ill and therefore at greater risk of developing complications. However, we are unable to comment on the statistical significance of these findings because the sample size was too small, the major limitation of this study. There were only ten patients in the transfusion group.

Complication risks from other studies vary between 20 and 50% (2, 11, 13, 16, 18). Homi et al in 1979 (9) found a complication rate of 13% among those who did not require pre-operative transfusion and 28% among patients who did, and an overall rate of 19%. The Vichinsky study (7) showed a complication rate of 35% in the patient group receiving the conservative transfusion approach and 31% in the aggressive transfusion group. Koshy et al (19) had a 33.3% complication rate in those patients who were not transfused, and 21.6% in the transfused group. Our overall results and those among the non-transfused group are comparable to these studies. One possible reason why the UHWI selective transfusion approach does not appear to precipitate unduly high complication rates among non-transfused patients is that SCD patients at steady state haemoglobin levels are well compensated cardiovascularly, allowing them to tolerate the stresses of anaesthesia and surgery.

Ideally, a randomized case control study is required to adequately compare approaches to perioperative transfusions in patients with sickle cell disease. Power calculations based on the findings of this study suggest that a sample population of 300 patients would be required to achieve statistically significant findings. To carry out such a study in a reasonable time period would require a multi-centre approach and a reliable blood supply.

In conclusion, a selective transfusion approach is practised at the UHWI with morbidity within acceptable limits and no perioperative mortalities among our sample population during the study period. SCD patients with a mild chronic course of disease, a haemoglobin level not greater than 2g/dl below the steady state and who are asymptomatic for anaemia at the time of preoperative assessment, may not require routine preoperative transfusion for minor procedures. A large prospective case controlled study to assess the impact of the UHWI selective transfusion practice on outcome is needed.

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