Correlates of emergency response interval and mortality from severe anaemia in childhood

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Summary

A retrospective study to determine the influence of blood transfusion emergency response interval on Mortality from childhood severe anaemia was carried out. Admission records of all children with severe anaemia over a 5-year period was reviewed. Those who either died before transfusion or got discharged against medical advice were excluded. A total of 5790 patients were admitted during the 5 year period. Ten percent (10%) had severe anaemia. Malaria, the leading cause of anaemia in this series, was found in 80% of the patients. Twenty patients (3.3%) died before transfusion while 50 discharged from the hospital against medical advice. There was male preponderance. Ages 2-5 years were the peak age group for severe anaemia. No patient had haematocrit less than 5% but 20 (4.2%) had heaematocrit above 20%. The hospital stay for majority (74.8%) of the patients was 72 hours or less. Mortality (Case fatality) increases with increase in transfusion emergency response interval within 24 hours. Based on the transfusion emergency response interval versus mortality curve, a mortality risk assessment scores were derived for use in clinical practice to determine the risk of dying from the disease. We recommend that national or hospital policy on blood transfusion be enunciated to ensure that all patient with severe anaemia get transfused within 2 hours of diagnosis.

Keywords: ***Transfusion Emergency response interval, Mortality, Mortality risk assessment scores.***

Résumé

Une étude rétrospective pour examiner l'influence de la réaction par intervalles de la transfusion du sang d'urgence sur la mortalité à travers l'anemie infantile grave, a été effectuée.

Enregistrement d'admission de tous les enfants souffrant de l'anémie grave au cours d'une période de 5 ans a été passé en revue, à l'exception de ceux qui étaient morts soit avant la transfusion soit ceux qui étaient sorti de l'hôpital san permission. Un nombre total de 5,790 malades ont été hospitalisés au cours de cette période de cinq ans. Dix pourcent (10%) avaient l'anémie grave. Le paludisme, qui prend la tête dans la cause de l'anémie en cette série était noté chez des malades, vingt malades soit (3,3%) étaient morts avant la transfusion tandis que 50 avaient quitté l'hôpital sans la consultation médicale.

On avait remarqué la prépondérance de mâle. Le groupe de la classe 2 à 5 ans était l'âge maximum pour l'attaque de l'anémie grave. Aucun malade avait l'hématocrit, moins de 5% mais 20 soit (4,2%) avaient l'hématocrit plus de 20%. La durée de l'hospitalisation pour le plus grand nombre des malades 74,8% était 72 heures ou moins.

Le mortalité (cas montel) s'accroit avec l'accrossement de la transfusion d'urgence réaction par intervalles en moins de 24 heures. A travers la transfusion d'urgence reaction par intervalle par rapport à la coube de la mortalité, des scores de la répartition des risques de morts (mortality risk assessment scores) étaient tirés à l'usage des clientèle cliniques pour déterminer le risque des morts à travers la maladie. Nous proposons que la politique nationale ou de l'hôpital sur la transfusión du sang soit précise et claire pour assurer que tous les malades avec l'anémie grave recoivent la transfusion en moins de 2 heures de la diagnose.

Introduction

On several occasions children are rushed into hospitals because of severe anaemia from various causes. The causes and rate of developemnt of anaemia determine the type of treatment to be given. However replacement of red cell is indicated once the anaemia becomes severe enough to compromise tissue oxygen delivery[1,2].

Packed cel volume per se is a good indicator of anaemia but not a true reflection of tissue oxygen delivery because of compensatory increase in cardiac output. In comparison, clinical evidences of decompensating cardiac function are more indicative of disease severity and potential death if anaemia is not promptly corrected. Consequently the rapidity with which blood can be made available to these children is a potential determinant of survival[3,4].

The purpose of this retrospective study is to evaluate the influence of the emergency response interval on the mortality from severe anaemia among children and identify the factors responsible for delay in emergency response. We have observed severely anaemic children die in the hospital while waiting for blood transfusion due to delay in emergency response. We have observed severely anaemic children die in the hospital while waiting for blood transfusion due to delay in the availability of appropriate blood or its products.

In the tropics and sub-tropical regions of the world emergency care responsiveness is slow with an attendant increased emergency response interval that may increase mortality. Hence this present study was carried out to locate the present status of our emergency response to severely anaemic children and the likelihood of dying from severe anaemia.

Method

This retrospective study involved a review of the admission records of the patients with severe anaemia cared for in the Emergency Paediatrics Unit (EPU) of the University of Ilorin Teaching Hospital (UITH), Ilorin, Nigeria over a 5 year period January 1994 to 1998. Information extracted for this study included: Age, sex, date of admission, time of diagnosis, time of commencement of blood transfusion, the causes of anaemia and the treatment outcome. The 20 patients who died before transfusion and the 50 patients who were discharged against medical advice were excluded. Data was entered into IBM compatible personal computer. Analysis was done on Epi Info version 6.02 and emergency response interval versus mortality curve was designed using Microsoft Excel[5].

Result

A total of 5790 patient were admitted into the EPU over the 5 year period. Six hundred (600) had severe anaemia due to various conditions. Incidence of severe anaemia was 10.4%. Fifty patients (50, 8.3%) were discharged against medical advise (DAMA) and twenty (20, 3.3%) died before transfusion while the remaining five hundred and thirty (530, 88.4%) received blood transfusion. There was male preponderance. Male 335 (53%). Female 265 (45%) with a male to female ratio of 1:0.7. Forty patients died among the 530 patients in consideration due to anaemic heart failure and hypoxic encephalopathy. Case fatality was 7.6%.

Among the 120 patients that had blood transfusion within 2

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hours of diagnosis 1 (0.8%) died and 119 (99.2%) survived. One hundred and ninety eight (198) were transfused within 3-6 hours of diagnosis, 4 (2%) died and 194 (98%) survived. Ninety patients were transfused within 7-10 hours of diagnosis 7(7.8%) died and 83 (92.2%) survived. Also, of the 54 patients that were transfused within 11-15 hours of diagnosis 9 (116.7%) died and 45 (83.3%) were alive. Of the 38 patients that were transfused within 16-20 hours of diagnosis 10 (26.3%) died and 28 (73.7%) survived. Among the 17 patients that were transfused within 21-24 hours of diagnosis 6(35.2%) died and 11 (64.8%) were alive while of the remaining 13 patients that were transfused after 24 hours of diagnosis 3 (23.1%) died and 10 (76.9%) survived. (Table 1).

Table 1 Emergency response interval and mortality from severe anaemia

Interval		Outcome			
(Hours)	Number	Number alive	%	Death	%
1-2	120	119	99.2	1	0.8
3-6	198	194	98	4	2.0
7-10	90	83	92.2	7	7.8
11-15	54	45	83,3	9	16.7
16-20	38	28	73.7	10	26.3
21-24	17	11	64.8	6	35.2
>24	13	10	76.9	3	23.1
Total	530	490		40	

**20 Patients died before transfusion was commenced*

Figure 1 emergency response interval versus mortality curve shows increase mortality with increase interval. The mortality at different reaction time were compared for significant differences, at <6 hours versus >6 to 10 hours Chi squared was 9.04, P-value was 0.003 and odds ratio was 5.1. At >6-10 hours versus >10 hour – 24 hour Chi squared was 6.17, P-value was 0.013 and odds ratio was 2.95. At <10 hour versus >10-24 hours Chi squared was 40.69, P-value was 0.000 and odds ratio was 7.8 and <24 hours versus >24 hours Chi squared was 3.47, P-value was 0.09 and odds ratio was 0.31 (Table 2).

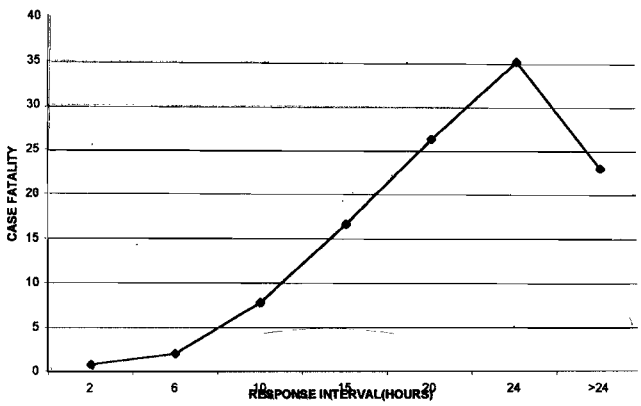

Fig. 1 ***Correlates of transfusion emergency response interval and mortality from severe anaemia in childhood (response interval versus mortality curve)***

Table 2 Comparism of mortality at different emergency response interval

Interval(Hours) Difference	Chi-Square	P-value	Odds Ratio	
<6 versus >6-10	9.04	0.003	5.1	Significant
>6-10 versus >10-24	6.17	0.013	2.95	Significant
<10 versus >10-24	40.69	0.000	7.8	Significant
<24 versus >24	3.47	0.09	0.31	Not significant

P-value <0.05 is significant

The distribution of the patients by age was as on Table 3. Infants were 170 (28.3%), age group 2-5 years were 345 (57.5%) age group 6-12 years were 75 (12.5%), while age group 13-15 years were 10 (1.7%).

Table 3 Distribution of severe anaemic patients

Age (Years)	Number	%
<1	170	28.3
2-5	345	57.5
6-12	75	12.5
13-15	10	1.7
Total	600	100

The distribution of the patients by haematocrit (Ht) were as follows (Table 4). No patient had haematocrit <5%, 140 (23.3%) patients had haematocrits between 6-10%, 235 (39.2%) had 11-15% haematocrit, 200 (33.3%) had haematocrit of 16-20%) while 25 (4.2%) had haematocrit greater than 20%.

Table 4 Distribution of severe anaemic patients by haematocrit

Haematocrit (%)	Number	%
<5	0	0
6-10	140	23.3
11-15	235	39.2
16-20	200	33.3
>20	25	4.2
Total	600	100

The causes of anaemia were as follows; malaria in 480 (80%) patients, sickle cell anaemia in 150 (25%) patients, protein calory malnutrition in 120 (20%) patients, septicaemia in 100 (16.7%) patients, bronchopneumonia in 96 (16%) patients, glucose-6-phosphate dehydrogenase deficiency in 22 (3.6%) patients, autoimmune haemolytic anaemia in 12(2%) patients, leukemia in 8 (1.3%) patients and disseminated intravascular coagulation due to snake bite poisoning in 3 (0.5%) patients (Table 5).

Table 5 Causes of severe anaemia among 600 children

Causes	*Number	%
Malaria	480	80
Sickle cell anaemia	150	25
Protein Energy Malnutrition	120	20
Septicaemia	100	16.7
Bronchopneumonia	96	16
G-6-P-D deficiency	22	3.6
Autoimmune haemolytic anaemia	12	2
Leukemia	8	1.3
DIC due too snake bite poisoning**	3	0.5

**Some patients had multiple diagnosis*
***DIC = Disseminated intravascular coagulopathy*

Table 6 Duration of hospital stay

Days	Number	%
1-3	449	74.8
4-7	90	15.0
8-14	7	1.2
>14	3	0.5
Total	550*	100

**Excluding those that discharge against medical advise*

Table 7 Mortality risk assessment score (M-RAS) in severe childhood anaemia

Response interval Hours	Risk of death (Mortality risk)	Scores
<2	RI-Almost NIL	1
2-6	R2-Low	2
6-10	R3-Moderate	3
10 – 24	R4-High	4
>24	R5-Very High	5

The duration of hospital stay was as presented on Table VI, 440 (74.8%) patients spent between 1 to 3 days, 90 (15%) patients spent 4 to 7 days, 7 (1.2%) patients spent 1 to 2 weeks while 3 (0.5%) spent more than 2 weeks in the hospital.

Discussion

Emergency response interval takes into consideration the period between diagnosis and the time of onset of blood transfusion which usually may not be truly representative of the time patient expended in the hospital. Much time may be spent on consultation bureaucracies like retrieving record folder, making payments and waiting to take turn to see the doctor all of which could not be represented in the records. However, as noted by Bamigboye et al[6], the time spent in the hospital may be lengthened or shortened by many factors.

The prevalence of severe anaemia of 10.5% is comparable experiences from other local centers in Nigeria and to that of 7.8% reported from Vermont initially but much higher than the 3.6% reported later from the same center[7]. This variation can be attributable to the high prevalence of sickle cell anaemia, malnutrition, and malaria and infestations in our environment. There was increase case fatality (CF) with increase emergency response interval. This correlation continues until 24 hours reaction time, after which CF falls. This is consistent with logical thinking and previous findings[2,4].

Our study showed an emergency response interval versus mortality curve with significant prognostic outlook that is suggestive of a graded risk of death at different intervals. We therefore suggest a mortality risk assessment score (M-RAS). Scores were as follows; 1 for almost no risk of death, 2 for low risk, 3 for moderate risk, 4 for high risk and 5 for very high risk, (Table 7).

To minimise fatality, transfusion must be given within 3 hours of diagnosis. Within 6 hours emergency response interval risk of dying is low and this steadily increases as emergency response interval increases. The M-RAS can therefore be used to communicate death risk on individual patient to the minds of health planners and the physicians and the urgent need to reduce reaction time and hence mortality, through transfusion policy and improved quality of standard care.

However, the observed decline in the CF among the patient whose transfusion inadvertently got delayed beyond 24 hour emergency response interval showed no statistically significant difference from the mortality within 24 hours. The decline may be related to the therapy from better medical opinion which was not available for those who died within 24 hours emergency response interval. Such therapy included administration of frusemide to reduce pre-load on the heart. The quality of care usually improved steadily over 72 hours of admission due to opinions from case reviews by higher cadre physicians. However, no standard of care should transfuse any patient later than 24 hours of diagnosis.

Most of the patients were discharged within 72 hours of admission. This is understandable because the leading cause of severe anaemia was malaria which is treatable within that period; once the child has been transfused they may be discharged to complete anti-malaria therapy at home if not completed yet. The reason why no one came with heamatocrits less than 5%, may be because they died at home. It could then be concluded that such haematocrit is not compatible with life in our environment. At that low haematocrit the level of hypoxia could result not only into cardiac malfunctioning but also encephalopathy and adrenopathy and eventual death[8].

The age distribution of anaemia Table 2 shows that age group 2-5 years were most vulnerable. Infants were likely to have some protection from their mother and less predisposed to having malaria or malnutrition because most got exclusively breast fed. At the age group 2-5 years when nutrition is no longer adequate and malaria immunity has remarkably waned off form the circulation then severe malaria and bacterial infection are most likely to occur at that time[9]. The leading cause of anaemia and the spectrum of diseases responsible for severe anaemia were comparable to previously reported in our environment[9].

We suggest that more aggression be shown to reduce the Blood Transfusion emergency response interval to reduce case fatality from severe anaemia most especially in the vulnerable ages. A hospital policy that will enable transfusion to be undertaken within 2 hours of diagnosis is desirable. Also further research should be carried out to address issues that may be responsible for the delay in transfusion that may cause unnecessarily prolonged emergency response interval.

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