

**BLOOD TRANSFUSION PRACTICES IN CHILDREN ADMITTED AT
KENYATTA NATIONAL
HOSPITAL, KENYA.**

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DECLARATION

I declare that this dissertation in part fulfilment of M.Med (Paediatrics and Child Health) is my original work and has not been presented to any other university or forum.

Signed  Date 18/11/06

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This dissertation has been submitted for consideration with our approval as University supervisors.

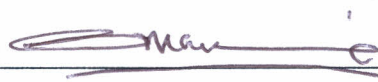
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DEDICATION

To the children of the world whose health I crave and yearn for.

To my son Onesphoro, for being my best friend

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ABSTRACT

Background: Transfusion practices have undergone intense evaluation since early 1980s as a result of increasing awareness of the risks of blood transfusion, escalating costs of blood processing, and diminishing supplies due to shrinking donor pool. With this in mind, the Ministry of Health (M.O.H) Kenya has published guidelines for appropriate use of blood. In spite of fairly clear guidelines regarding use of blood, inappropriate transfusions continue worldwide. While transfusion is a common form of therapy for paediatric patients at Kenyatta National Hospital (KNH), there is paucity of data as to how the transfusion practices conform to the set guidelines.

Objective: To determine the extent to which current practices of blood transfusion for paediatric patients at Kenyatta National Hospital conform to the set guidelines.

Setting: Kenyatta National Hospital (KNH), a large tertiary care and teaching hospital.

Design: Hospital based cross-sectional survey

Main outcome measures: Proportion of blood transfusions classified as compliant or non-compliant with the Kenya National Guidelines for Appropriate use of Blood and Transfusion Services (KNG-AUBTS)

Method: Over a four-month period, all blood transfusion requests, for patients aged 12 years and below were scrutinised. Demographic data, transfusion reasons/indications, laboratory data (haemoglobin level, PCV), volume of blood requested, and the degree of urgency were noted. Vital signs, clinical assessment of the patient, the type of admission (emergency or elective) and working diagnosis were also noted and all the details were entered into a proforma sheet. Each transfusion episode was classified as appropriate or inappropriate depending on whether or not it conformed to the indications in the Kenya National Guidelines for the appropriate use of blood.

Results: Four hundred thirteen transfusions were reviewed during the 4-month period. All the study subjects were aged 10 years and below. One hundred and seventy six (42.6%) were male and 237(57.4%) were female. More than half (55.2%) of the transfusion episodes occurred in children aged two months and below.

Of the three indicators used to determine appropriateness of transfusion, 298 (72.2) were transfused for appropriate clinical indications, 152 (36.8%) had appropriate blood volume transfused, and 271 (65.6%) were transfused within an appropriate time period of 36 hours or less. Eighty-seven (21.0%) of the transfusions fully satisfied the combined criteria of appropriate time between request and transfusion, appropriate volume of blood transfused and appropriate clinical indications. Of the factors evaluated ; age, gender, reasons for blood request and time of transfusion, none significantly influenced the appropriateness of clinical indications of blood. Appropriateness of volume transfused was significantly influenced by reasons for blood request while appropriateness of time interval between blood request and transfusion was significantly influenced by reasons for blood request, blood group and time of blood request.

Conclusion: Using the recommended guidelines for appropriate use of blood, the findings of this study indicate an extremely low rate (21%) of appropriate blood transfusion. The most frequent cause of deviation from the set guidelines was the volume of blood transfused. Mechanisms of ensuring that clinicians involved in blood transfusion services strictly adhere to the set guidelines should be instituted. One needs to look into the causes of the wide deviation from the standards, in the volume of blood transfused. Also, causes for the delays in blood transfusion need to be identified and rectified.

INTRODUCTION AND LITERATURE REVIEW

History and Definition of blood transfusion

The term transfusion refers to taking blood from one living thing and injecting it into the blood stream of another. A transfusion can either be autologous, where one's own blood is re-infused, or allogeneic, from someone else (donor) other than the recipient.

Transfusion of blood from one dog to another was successfully achieved in the seventeenth Century [1], though transfusion of human blood to treat trauma and disease was not undertaken until 1667 [2]. Earlier transfusions were associated with high mortality but the puzzle of why some transfusions resulted in complications while others were successful was solved by Karl Lansteiner 1901 when he documented the first three human blood groups. A fourth group was discovered by DeCasterello and A. Stuart in 1902 [1-4].

In earlier attempts, blood was either collected in paraffin containers or directly transfused from donor to recipient through direct vascular communications. The concept of blood banking and blood preservation had its beginning during the World War II [3]. This did not only ensure that blood was readily available but also brought with it the temptation to transfuse all too frequently even when blood was not required [5] Between the years 1970 and 1980, the rate of red blood cell (RBC) transfusion doubled [6].

Over the years, the technology of collection and preservation of blood for transfusion has been greatly improved. With introduction of blood bags and separation of blood into components in 1953, blood banking started to gain greater sophistication [2] and this marked the beginning of modern era of transfusion practices.

Transfusion of allogeneic blood is very common in paediatric practice, with children receiving 50-67% of all transfusions given in many African countries [7,8, 19]. In spite of this, epidemiological data on paediatric transfusion practices is lacking [9].

The process of transfusion practice should be designed to direct the clinician to utilise the available resources in the most optimal way. This has led to development of guidelines with input from published data and are aimed as a practical tool to help reduce inappropriate transfusions [10]. However use of blood outside the set guidelines is common [11]. Concerns now exist particularly given the recognised risks of blood transfusions [12] the decreasing availability of blood donors [13] and the rising costs of blood transfusion [14]

Indications of blood transfusion

In Africa, blood transfusions are frequently given to treat anaemia in children [7-8,18-19]. Clinical indications for transfusion of blood vary depending on age of patient, the aetiology, severity and duration of anaemia, coexisting cardiopulmonary or vascular conditions and on the haemodynamic stability of the patient. Chronic anaemia is better tolerated than acute anaemia and unless the patient is symptomatic, blood transfusion is rarely indicated. Transfusion of whole blood may be appropriate when a patient has acute blood loss that is severe enough to cause symptoms of hypovolaemia [15]. Less acute haemorrhage or anaemia can appropriately be treated with either packed or concentrated RBC [15]. Red blood cells augment the oxygen carrying capacity hence red cell transfusions are reserved for inadequate oxygen delivery to tissues related to haemoglobin. The 'transfusion trigger' or minimum haemoglobin at which transfusion

must be given has been the subject of controversy [16]. Many physicians consider a minimum haemoglobin level of 7g/dl as an indication for blood transfusion while others dispute the concept of 'transfusion trigger' and instead advise on careful monitoring for evidence of inadequate oxygen delivery on a case-by-case basis. Okafor [17] found that signs rather than the level of packed cell volume (PCV) are a better basis for transfusion. Reliance on PCV alone is likely to lead to inappropriate use of blood. However, Lackritz [18] found that based on the basis of laboratory criteria only, children with haemoglobin <3.9g/dl who were transfused had a lower mortality than those with haemoglobin 3.9g/dl who were not transfused but this finding applied only to children transfused on the day of admission. It would thus seem logical and appropriate to transfuse all children with haemoglobin <3.9g/dl regardless of presence or absence of clinical signs.

Blood transfusion in Special groups

Specific categories of children are particularly prone to inappropriate transfusions The Kenya National guidelines for the appropriate Use of Blood and Transfusion Services (KNG-AUBTS) recommend more care while dealing with neonates and congenital anaemias such as sickle-cell anaemia (SCA).

Neonates

The KNG-AUBTS highlights the unique issues of the neonate. The blood volumes of the neonate are much less than older children, hence neonates are generally given small volumes but repeatedly, increasing the risks of transfusion. One should avoid using blood donated by relative to transfuse neonates.

Neonates, particularly those who are premature, are among the most commonly transfused [20] Many infants require multiple RBC transfusions, with some receiving cumulative volumes exceeding their total blood volume [21] This exposes the neonate to multiple donors with increased risk of adverse effects especially transfusion associated infections. Many of the transfusion related infections have a long latency period and hence much more significant in neonates with a normal life expectancy. Ninety percent (90%) of all RBC transfusions in neonates are for replacement of blood drawn for laboratory studies [22] hence, limiting blood sampling significantly reduces neonatal transfusions. In patients with anaemia and congestive cardiac failure (CCF), or thrombocytopaenia with bleeding, neonatal transfusions are clearly indicated but in some patients the indication for the transfusion may not be clear-cut. RBC transfusions are used to maintain the haematocrit above 30% for sick neonates with poor weight gain [23]. Maintenance of levels of haematocrit at higher than 30% is appropriate in neonates with cardiopulmonary problems since tachypnoea, dyspnoea and apnoea could be exacerbated by anaemia due to reduced oxygen delivery to the respiratory centre [24]. In assessing the need for transfusion for preterm infants, the role of haematocrit level, clinical signs and erythropoietin is not clear [25]. No clear relationship has been found between haematocrit and either heart rate, respiratory rate or the incidence of apnoea [26]. A study by Blank et al [27] found no advantage for prophylactic use of small RBC transfusions in otherwise 'well' growing premature infants. In the study, they did not find any substantial differences in the length of stay, frequency or severity of apnoea, or days required to regain birth weight between, "well", "transfused neonates" and the "non-transfused" group. Blood transfusion in neonates, thus, seems not to have clear criteria

and the traditional criteria of “symptomatic” anaemia- pallor, lethargy, poor weight gain, tachypnoea, tachycardia, apnoea or bradycardia may result in either over- or under-transfusion.

Haematological conditions

The administration of blood in management and/prevention of the complications of haematological conditions, such as sickle cell disease (SCD), is very frequent. SCD is the most common haemoglobinopathy, the incidence being as high as 35% for the heterozygous in equatorial Africa [28]. Using SCD to represent other haematological conditions that require repeated transfusions, it then becomes easier to understand why we need to avoid unnecessary transfusions. The likelihood that a person with SCD will receive a transfusion depends on age and genotype but majority of affected persons will receive at least one transfusion during their lifetime [29]. The main indications for transfusion in SCD are to reverse or prevent the effects of anaemia, vaso-occlusion or both [30]. Though blood transfusion can be life saving and life-prolonging in a variety of clinical settings, one should always consider the multitude of transfusion related complications as well as the unique property of haemoglobin S (HbS) when considering transfusion in this group. Homologous transfusion in SCD is associated with many complications including; hyperviscosity [31], iron overload [32] hypersplenism [33] on top of all other complications of transfusion.

Although new methods of managing SCD, such as antisickling agents and bone marrow transplant, may in future reduce the need for transfusion therapy, future clinicians will no doubt have to deal with a few frustrations resulting from current day inappropriate

transfusions in SCD and other haematological conditions that require chronic transfusions.

The KNG-AUBTS recommends that children with SCD, like other children, should only be transfused when they develop cardio-respiratory symptoms from severe anaemia. The transfusion goals should be to treat or prevent the acute or chronic complications of the disease but not to normalise the haemoglobin. Hypertransfusion is usually indicated in SCD to prevent refractory vaso-occlusive complication or stroke

Problems of blood transfusion

Blood Availability

The availability of blood is severely limited in many African countries partly due to traditional beliefs, taboos and superstitions against blood donations [34]. A good number of African children die from severe anaemia while awaiting relative donors. [35]. Inappropriate use also adds to the shortage. A study at KNH found that only 51% of all patients for whom blood was requested had blood cross-matched [36] Lack of paediatric blood packs results in a lot of wastage since the 500mls pack is used even when smaller volumes are required. In the study, 62% of paediatric patients were transfused with less than 500 mls while 44% required less than 250 mls.

Worldwide, blood donations increase at a rate of 1% per year [37]. In Kenya, the advent of HIV/AIDS with a national seropositivity of 6.7%, has greatly affected the blood supply. A survey done in the year 2001 revealed that 70% of blood used in hospitals was from relative donor and only 30% was ordered from blood banks [35]. It was also noted that inappropriate transfusions lead to difficulties in sustaining the blood supply. In

Kenya, whole blood is the only readily available blood product [36] hence higher chances for its inappropriate use. Kenyatta National Hospital receives about 75% of all collections by the national blood transfusion service (NBTS) and uses about 750 units per month. Only 17% of this blood is from volunteer donors, the rest over 80% is blood from relative donors [55].

Costs

Blood transfusions add significantly to health care costs. The costs incurred may either be direct or indirect. Forbes [14] evaluated the costs of delivering a unit of blood to a hospitalised patient and found that the costs vary from hospital to hospital, but most hospital incurred a cost of US\$155 to transfuse a unit of RBC and charged US\$219 per unit. Laboratory testing, administration of blood, acquisition, and handling accounted for 43%, 7%, 37% and 13% respectively. Stricter donor recruitment criteria, coupled with increasing screening tests have added to cost of blood collection. In Kenya, it is the government's responsibility to provide safe blood for its citizens. No actual studies have been done to establish exactly how much it costs the country to provide safe blood to a patient, but an estimate of Ksh 1052 (an equivalent of US\$ 14) for a unit of whole blood has been made [38]. In Zimbabwe and South Africa, the cost of a single transfusion-from recruiting donor in the community to transfusing it with safe sterile equipment in a hospital-is estimated to be US\$20-US\$30 [14].

Bed occupancy while awaiting transfusion, treatment of blood reactions or complications and in some situations loss of life especially in haemorrhage accounts for some of the

indirect costs of blood transfusion. Adoption of more appropriate transfusion practices significantly cut the costs.

Safety of blood Transfusion

Blood transfusion continued to provide a vital therapeutic modality essentially unchallenged until early 1980s when the importance of blood safety was recognised [39]. Transfusion practices came under more scrutiny, and it became necessary to devise ways of making blood transfusions safer. Safe transfusion can be achieved by: Using appropriate blood components as opposed to whole blood [15] and Screening of all donated blood for transmissible disease such as, Hepatitis B and C viruses, Human Immunodeficiency Virus (HIV one and two), Treponema palladium antibody (Syphilis), chagars disease and malaria. Other ways of ensuring blood safety include; effective blood donor education and recruitment programs for donor selection and screening, blood grouping, compatibility testing, and storage and transportation of blood products [38]. Use of alternatives to allogeneic blood transfusion, such as erythropoeitin, where applicable [40] and development of guidelines to ensure more appropriate and more consistent transfusion of blood products result in reduced risks of blood transfusion [10]. Approximately 20% of all blood transfusions result in some adverse effect in the recipient despite all safety measures [12]. The risks may be acute or chronic, infectious or non-infectious, fatal or non-fatal. Their occurrence is influenced by the nature of recipient, source of blood donor and the expertise of blood bank laboratory staff. Although careful donor selection and extensive laboratory testing have reduced the risks current estimates still indicate that the risk of contracting a viral infection from a unit of

blood ranges from, 1:63000 for HBV, 1:103000 for HCV, 1:676000 for HIV and 1:641000 for HTLV 1& 2. [41] and 1:10.000 for Parvovirus [41]. Cytomegalovirus (CMV) is an important infectious complication of blood transfusion especially in the neonates and immunocompromised individuals [42]

Despite parasitic infections being an uncommon risk, a few parasites such as malaria [43], babesiosis [44] and trypanosomiasis [44] can be transmitted via blood transfusion depending on prevalence and donor selection. Although bacterial contamination of blood and blood products is rare, transfusion associated sepsis has been documented [45]. Recently there has been concern over the theoretical risk of variant Creutzfeldt-Jakob disease (CJD) transmission through blood transfusion [46]. Non-infectious hazards include; incorrect blood transfusion which occur in about 58% of transfusions [47], acute transfusion reactions (13%), delayed transfusion reactions (32%), post-transfusion purpura (4%) transfusion-associated graft versus host disease (TA-GVHD)-1%, acute lung injury (6%) and other unclassified reactions (3%) [47].

Compliance with recommended guidelines

Practice guidelines are systematically derived statements that can inform clinical decision-making with an aim of harmonising clinical practices. While details of different transfusion guidelines may vary, the principle underlying most transfusion guidelines are similar and combine a clinical assessment of whether the patient is developing complications of inadequate oxygenation with measurement of their haemoglobin. However, transfusion of blood outside developed guidelines is common [48-51].

Worldwide, the extent of inappropriate use of blood and blood products is not known but published estimates for RBC vary from greater than 97% to less than 30% [52] depending on the criteria used to define appropriate transfusion and guidelines used.

In Canada, an expert working group [10] considered that few patients have clinical signs and symptoms of anaemia when haemoglobin (Hb) level is 7g/dl. They stated that weakness occurs at Hb level of 6g/dl; dyspnoea at rest at Hb level 3g/dl and congestive cardiac failure (CCF) at 2-2.5g/dl. They suggested that transfusion is thus rarely required at Hb levels greater than 6g/dl. In Tanzania [8], blood is recommended for Hb <4g/dl in chronic anaemia and Hb >4g/dl if the child also has CCF and/or hypoxic spells for children aged less than five years and Hb <5gdl with either, CCF, hypoxia, severe infection or haemolytic crisis for children older than 5 years. Although studies on of blood transfusions are scanty in our set up, a few studies so far published [7,18-19] point out on a few issues concerning blood transfusion. Lackitz [7] found 47% of paediatric transfusions to be inappropriate: 23% of the transfused children did not meet the criteria of having a haemoglobin of <5g/dl and clinical evidence of respiratory distress. In their study, transfusions were often delayed due to reliance on patient-recruited donors. This led to 27% of the children being transfused 2 or more days after requested. Transfusion can significantly reduce mortality of children with anaemia but it may not have benefits unless it is given within the first two days of transfusion. children with severe anaemia, blood transfusion has been shown to reduce mortality only if given within two days of admission [18]. In Siaya district hospital Kenya [18], children with clinical signs of respiratory distress and Hb, <4.7g/dl who were transfused had a lower mortality than those who were not. Based on laboratory criteria only, children with Hb< 3.9g/dl who

were transfused had a lower mortality than those with Hb<3.9g/dl who were not transfused but this finding applied to children transfused on the day of admission or the day after. In yet another study, Lackritz found that 34% of the transfusions were given 2 or more days after they were ordered thus exposing the children to transfusion risks without obvious benefits [19]. In the study, transfusion was noted to have greatest impact on survival of children with respiratory distress but the benefit was limited to the first two days of hospitalisation. In all these studies, they concluded that the three key indicators for beneficial transfusion were: timing of transfusion, haemoglobin concentration and clinical status.

A study in Mwanza Tanzania by Jenedian Vos between 1990-1993 showed that 23%-39% of blood transfusions could have been avoided and 22% were given without an obvious indication [8]. Of all the avoidable transfusions, 75% were given to children under the age of five years. Other studies in Africa and other parts of the world have reflected high rates of inappropriate use, not only of RBC, but other blood products too [11,48-51].

Even with appropriate clinical indications, the appropriate volume to be transfused may be questionable. Studies on appropriate volume of blood to be transfused are scanty but the KNG-AUBTS is clear on the volumes of blood to be transfused. A pre-determined volume is use based on the body weight. Single unit transfusions have been condemned as inappropriate use of blood [53] but appropriate use of blood entails transfusion of small volumes until symptoms wane off, hence a pre-determined volume need not be utilized fully if symptoms disappear at a less volume [54]. Owiti [38] also commented on the wastage of blood due to the small volumes required by paediatric patients.

The timing of blood transfusion is as important as the volume and clinical indications. Studies have shown that blood transfusion improves mortality if given on the day of admission or the day after [7,18]. It would thus seem appropriate to take any blood transfused within 36 hours to be of clinical significance.

As a general rule then, RBC transfusions should only be given when absolutely necessary and the need for transfusion should be based on clinical signs of anaemia and the haemoglobin level. The transfusions should also be timely, and adequate in volume to relieve the clinical signs. Based on these principles, the Kenya National Guidelines for Appropriate use of Blood (KNG-AUBTS) were published. The guidelines recommend that appropriateness of transfusion should be based both on haematological and clinical status of the patient. The decision to transfuse should be based on the patient's risk for developing complications of inadequate tissue oxygen delivery. Though the guidelines are very clear on the volumes to be transfused, they state that blood only improves survival if given immediately at the time that it is needed its on the shortest or longest time that blood should be available. From previous studies, blood improves survival if given on the day of admission or the day after [7,18-19) hence blood transfused within this time can be assumed to be appropriate in time interval.

PROBLEM STATEMENT, STUDY JUSTIFICATION AND UTILITY

Paediatric patients are among the most transfused group of patients. The most transfused blood products are whole blood and red cell concentrates. Documentation of transfusion practices in a health facility would be of value in forming policies on how to improve the efficacy and efficiency of transfusion. Despite the set out guidelines, inappropriate use of blood is rampant in both developed and developing countries.

Inappropriate use of blood results not only in wastage of a valuable and rare resource but also subjects the recipients to unnecessary risks and unnecessarily high costs of medical care.

Few comprehensive studies have been performed on paediatric transfusion practices. Most information has been obtained from adult studies. This study was carried out to evaluate blood transfusion practices for children admitted at Kenyatta National Hospital.

It is hoped that the findings of this study will be of functional benefit on the transfusion practices for children admitted at KNH. The findings of this study will be promulgated to policy makers and medical staff so as to help correct transfusion practices that deviate from the set guidelines.

STUDY OBJECTIVES

Main Objective

To determine the extent to which current practices for transfusion of blood in children admitted at Kenyatta National Hospital (KNH), conform to the Ministry of Health, Kenya National Guidelines for appropriate use of blood.

Specific Objectives

- 1) To determine clinical indications for which blood is requested in children admitted at Kenyatta National Hospital.
- 2) To determine time intervals between request and administration of blood in children admitted at Kenyatta National Hospital.
- 3) To determine volumes of blood administered to children admitted at Kenyatta National Hospital.
- 4) To compare the above parameters with the recommendations of the Ministry of Health, Kenya National Guidelines for the appropriate use of blood

Secondary Objective

To determine factors that may influence the indications, time interval between request and transfusion and volume of blood administered to children admitted at KNH.

METHODS

Study Design

A hospital based cross-sectional survey was carried out.

Study area

The study was conducted at Kenyatta National Hospital (KNH), a 2000-bed capacity teaching hospital, which serves as the national referral hospital for Kenya. It also serves as a provincial hospital for Nairobi residents and its environs. The hospital has four main paediatric wards, which in total admit an average of 1200 children, every month. Paediatric patients are also be admitted for surgical procedures or for cancer therapy in the paediatric oncology wards. About 300 requests for blood and/or blood product are made every month, though less than 200 are actually transfused for the paediatric patients.

Study Population

The study subjects comprised of children aged 12 years and below.

Inclusion Criteria

All blood transfusion requests for children aged 12 years and below admitted to the paediatric wards or newborn unit during the study period.

Exclusion Criteria

- Children for whom blood was requested from another health institution and were admitted while transfusion was in progress
- Children admitted in the Intensive Care Unit and paediatric surgical wards.
- All children admitted for cancer therapy
- Neonates undergoing exchange transfusion.
- Patients for who blood was ordered but not actually given.

Sample Size Estimation

This was calculated using the formula

$$N = \frac{(Z\alpha)^2 (p(1-P))}{\delta^2} = 384$$

$Z\alpha$ == Normal Standard deviate corresponding to α -value of 0.05 in a two-tail test.

P = Estimated Prevalence of transfusions not conforming to the National guidelines.

δ = Margin of precision in estimation of "P" considered acceptable.

(Set at 5%)

$P=0.47$, was determined from previous published studies [7].

Sampling Method

Children who fulfilled the inclusion criteria during the study period were enrolled into the study consecutively until the desired sample size was attained.

Patients Recruitment and Procedures

A proforma sheet (Appendix-I) was used to collect the data. The investigator performed a physical examination on all patients whose details of clinical indications were not clear from the file and filled all the necessary details on the proforma sheet.

Over a three-month period, between February and April, 2005, every day between 8am and 8pm, the investigator requested the Blood Transfusion Unit (BTU) staff to alert her if they received a request for red blood cell for paediatric patients aged 12 years and below.

The details of the patient were obtained and the patient traced in the ward where the parent or guardian was informed about the study and consent was obtained.

The primary investigator then visited the BTU immediately and from each request card, the following details were extracted: Demographic data, ward, admission/principal diagnosis, laboratory data (Hb/PCV), Volume of blood requested for, reasons for blood request or stated indications, and the degree of urgency. For requests that were made at night, between 8pm and 8am, the investigator recruited the patients and scrutinized the requests the following morning at 8am. For all requests where the transfusion was given before, all efforts were made to get the pre-transfusion clinical state, either from the nurses' observation chart or from the notes of requesting doctor.

The patient's details were confirmed from the file and for all the patients a standardized physical examination was performed to document signs of cardio respiratory embarrassment- evidence of increased heart rate, respiratory rate, gallop rhythm and tender hepatomegally. Pre-transfusion Hb and/ PCV was recorded from the file.

The actual time of request was obtained from the file. Whether recorded or not the time was always ascertained with the requesting doctor to an approximation of plus or minus

ten minutes. The time the blood sample was recorded from BTU record book was also noted. The patient was then monitored to note the actual time that blood was available and when it was actually transfused. Availability time was taken as the period between the transfusion request by the doctor and the time of commencement of the transfusion. The investigator liaised with the nurse monitoring the transfusion process to get the actual volume that was transfused and determined if it tallied with the amount prescribed by the doctor. For all patients, solusets were used to ascertain the volume. The blood transfusion progress together with any transfusion reactions were noted. All these details were entered into a proforma sheet to a total of 413 transfusions.

Operational Definitions

Appropriateness of a transfusion episode

For a transfusion episode to be deemed appropriate, it had to satisfy the three criteria used to gauge appropriateness, i.e.:

(1) ***Appropriate clinical indications***- taken as any transfusion episode that fulfilled the criteria of low Haemoglobin for age according to the guidelines and signs and symptoms of CCF. All children transfused for Hb less than 4g/dl were considered appropriate even in the absence of CCF. CCF was take as a combination of tachynea, tachycardia gallop rhythm and tender hepatomegally.

(2) ***Appropriate volume*** was taken as 10-15mls/kg packed red blood cells (PRBC) in neonates or 15mls/kg in older children and 20mls /kg for whole blood. (Appendix-II).

(3) ***Appropriate time interval*** between blood request and transfusion was taken as being 36 hours and below.

The appropriateness of each transfusion episode was based on the Ministry of Health, Kenya National Guidelines for the appropriate use of Blood and Transfusion services (Appendix-II) and determined prospectively by review of blood requests cards, clinical examination of the patient, and laboratory data available. Each transfusion episode was evaluated independently and considered unrelated to prior episodes for a given patient. Thus, one patient could have several transfusion episodes, each for a different indication, but each transfusion episode could only have one indication.

Reasons of request were taken from the blood-ordering card.

Transfusion Episode

All blood that was transfused within a 24-hr period was considered to be the result of a single transfusion event. This was based on the assumption that, in general, all blood transfused during a 24-hr period would be for the same indication. Only one transfusion episode was counted for any particular patient even if multiple transfusions occurred within the study period..

Data Management and analysis

All data generated was recorded in a profoma sheet (appendix I) and then entered into an IBM personal computer. Data was analysed using Statistical Program in Social Science (SPSS). Descriptive statistics, means and median were used for most variables. Differences were considered significant when p-value was equal or less than 0.05. Data was presented using tables, pie chart and bar graphs as appropriate. Rates of appropriateness were compared against age and sex, reasons for transfusion request and principal diagnosis.

Ethical Considerations

Approval to carry out the study was obtained from the Kenyatta National Hospital Ethical and Research Committee. The objectives and procedures of the study were explained to the parent. Recruited children were identified using a study number and their in-patient number for confidentiality. The data was stored securely with due respect for the patient's confidentiality. The hospital staff according to routine practice gave all medical care, including the transfusion. The investigator did not influence in any way how much, why, when or how the blood was given.

RESULTS

During the study period, a total of 413 transfusions in children aged 12 years and below were reviewed. Of the total transfusion episodes, 228 (55.2%) occurred in children aged two months and below. The subjects comprised 176 (42.6%) males and 237 (57.4%) females, giving a male: female ratio of 2:3. The ages of the study subjects ranged from one day to ten years, with a median of 30.0 days. Weights of those transfused ranged from 0.6 to 35.0 Kg with a median of 3.0 Kg.

Volumes transfused ranged from 8.4 mls/kg to 61.8mls/kg with a median of 33.6ml/kg

Time interval between blood request and transfusion ranged from 1.5 Hrs to 168.0 Hrs, median, 26.1 Hrs. Pre-transfusion hemoglobin varied from 2.0g/dl to 14.6 g/dl, with a mean of 6.4g.dl. The main reasons for blood request were anaemia (85.5%) and bleeding (3.0%).

The most frequent principal diagnoses associated with transfusion were malaria (30.8%), SCD (6.5%) and neonatal sepsis (43.0%) either alone or in combination with other conditions.

The degree of urgency for the request ranged from, Desperate (10%), Very Urgent (15.2%) and the majority (74.8%) just indicated "As Soon as Available."

The most frequently transfused blood group was O Rhesus positive (56.4%) followed by B Rhesus positive (26.4%) and A Rhesus positive (13%).

Table I-Baseline Characteristics of the study Subjects

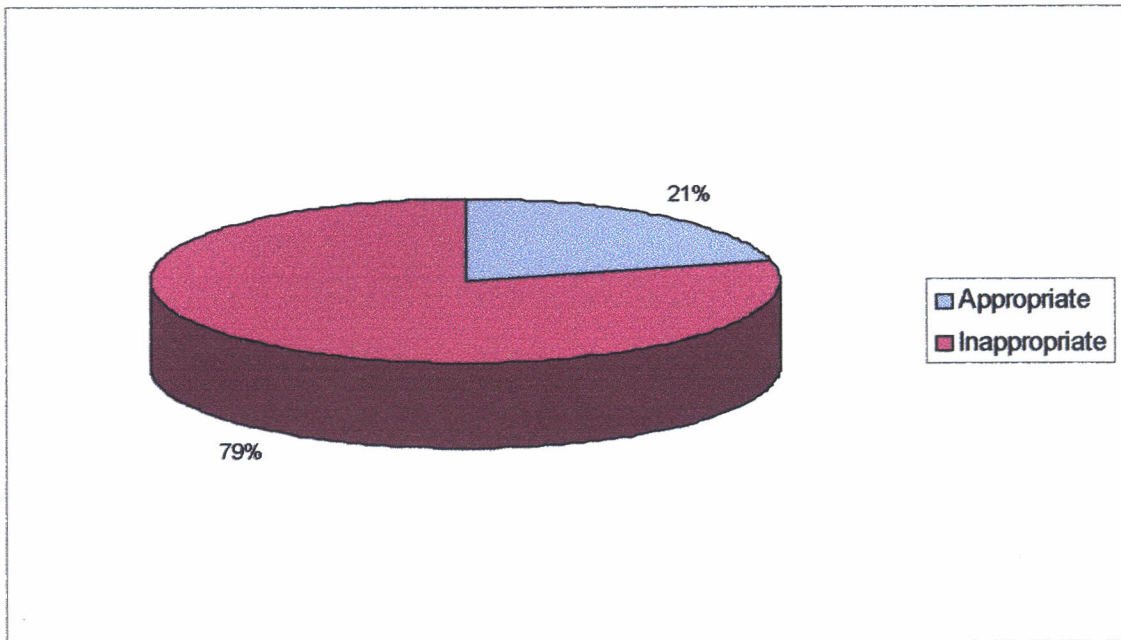
Characteristic	Range	Median	Mean
Age (days)	1.0 -3650.0	30.0	423.1
Weight (Kg)	0.6-35.0	3.0	6.0
Pre- transfusion Haemoglobin (g/dl)			
Neonates	6.6-14.6	8.3	8.5
Ono-neonates	2-8.4	4.5	5.1
Volumes of blood Transfused (mls/kg)	8.4 -61.8	33.6	53.5
Time interval between blood request and transfusion (Hrs)	1.5-168.0	26.0	34.7

Table II- Mean pre-transfusion haemoglobin by clinical conditions for which blood requests were made

Reason for blood request	Number (%)	Mean Pre-transfusion Hb level (g/dl)
Anaemia	353 (85.5)	6.01
Twin-twin transfusion	3 (0.7)	8.3
Haemorrhage	11 (3)	9.9
Haemolytic crises.	1 (0.2)	3.0
Anaemia and poor weight gain.	14 (3.4)	7.6
Anaemia and bleeding.	17 (4.1)	3.7
Anaemia with CCF	13 (3.1)	4.2
Bleeding and apnoea	1 (0.2)	14.2

Most of the requests, (85.5%) had anaemia as the main reason for blood request. The mean pre-transfusion haemoglobin seems higher for cases with bleeding, either alone or with apnoea, lower for anaemia, and lowest for bleeding with anaemia and haemolytic crisis (Table II).

Fig I-Overall level of appropriateness of blood transfusion regardless of the parameter used



Most of the transfusions were appropriate in only one aspect (47.4%), or in two aspects (30.4%). Only 87 (21.0%) of all the 413 transfusion episodes met the combined criteria of appropriate clinical indications, appropriate volume of blood transfused, and were transfused within an acceptable time of 36 hours or less. Of these 87 episodes, 42 (48.3%) were in neonates and 45 (57.7% were in children older than 2 months giving an overall rate of appropriateness of 18.4% for the neonates and 24.3% for the non-neonates. Twenty-eight (6.8%) of the transfusion episodes were not clinically indicated; subjects were either over- or under-transfused and they were transfused within a time greater than thirty-six hours i.e. they did not meet any of the criteria.

Table III-Clinical Indications as compared with the set guidelines

I	Anaemia in Neonates	N=228 (%)
	Hb <7 g/dl	77 (33.8)
	Hb 7-8 g/dl with apnoea, bradycardia, tachycardia, or reduced vigor.	53 (23.2)
	Hb <12 g/dl with RDS, or CHD or failure to gain weight for greater than 7 days.	31 (13.6)
	Other	67 (29.4)
II	Children older than 2 months (Excluding SCD)	N=158 (%)
	Hb < 4 g/dl	80 (50.6)
	Hb 4-5 g/dl with signs of respiratory distress or CCF	37 (23.4)
	Hb 4-5 g/dl clinically stable	29 (18.4)
	Hb> 5 g/dl	11 (7.0)
III	Children with SCD	N=27 (%)
	Children in acute crises	13 (48.1)
	Children on Chronic transfusion	2 (7.4)
	Other	12 (44.4)

A hundred and sixty-one (70.6%) of the transfusions among neonates satisfied the criteria of having either a Hb < 7g/dl, Hb between 7 and 8 g/dl associated with either apnoea, bradycardia tachycardia or reduced vigor either alone or in combination or Hb <12g/dl with associated RDS, CHD or failure to gain weight for >7 days.

Among the older children, 137 (74.1%) of the transfusions complied with the guidelines with a combined criteria of Hb, 4g/dl with or without signs of respiratory distress or CCF or a Hb between 4 and 5 g/dl with associated with signs of respiratory distress of CCF (Table-III, Figs II&III).

Table IV- Clinical indications, Volumes of blood transfused, and time interval between blood request and transfusion by age group

Appropriateness Indicator	Neonates (%)	Non - neonates (%)	Total (%)	P- Value
Clinical indications				
Indicated	161 (54.0)	137 (46.0)	298 (100)	
Not Indicated	67 (58.3)	48 (41.7)	115 (100)	0.46
Volume				
Appropriate volume	78 (51.3)	74 (48.7)	152 (100)	
Under-/ Over-transfused	150 (57.5)	111 (42.5)	261 (100)	0.38
Time interval between request and transfusion (Hrs).				
0-36	148 (54.6)	123 (45.4)	271 (100)	
>36	80(56.3)	62 (43.7)	142 (100)	0.41
Clinically indicated, appropriate Volume, and Time interval between blood request and transfusion (Combined)	42 (48.3)	45 (51.7)	87 (100)	0.31

Of the total transfusions, 298 (72.2%) had correct clinical indications

Only 152 (36.8%) of the subjects received appropriate volume, while the rest were either under-transfused 26 (6.3%) or, majority, 235 (56.9%) over-transfused.

The time interval between request and transfusion ranged between 1.5 and 168 hours.

Two hundred and seventy-one (65.6%) of the subjects were transfused within appropriate time of less than 36 hours. In 34.4% of the subjects onset of transfusion was more than two days following request for blood. (Table-IV).

Table V-Effect of bleeding on appropriateness of blood transfusion

Reason of blood request	Bleeding (%) N=29	Non-bleeding (%) N=384	P Value)
Correct clinical indications	55.0	73.4	0.34
<i>Appropriate volume of blood transfused</i>	52.0	36.0	0.21
Appropriate time interval between blood request and transfusion	100.0	63.0	<0.01

Reasons for blood request were divided into whether there was bleeding or not

Having bleeding as the reason for blood request significantly affected the time interval between request and transfusion ($P<0.01$) but not whether a transfusion was clinically indicated or not or the volume of blood transfused ($P=0.34$ and 0.21 respectively). All the children (7.0%) with bleeding as the reason for blood request were actually transfused within 36 hours of request i.e. 100% appropriate for time interval. If the patient was bleeding, it did not significantly affect the appropriateness of clinical indications ($P=0.34$) or the appropriateness of volume of blood transfused ($P=0.21$) (Table V).

Table VI-Factors Influencing the appropriateness of blood transfusion as determined using correctness of Clinical Indications

Factors	Appropriate (%)	Inappropriate (%)	Total (%)	P-Value
Reasons for blood request				
Bleeding	16 (55.2)	13 (44.8)	29 (100)	0.30
No-Bleeding	282 (73.4)	102 (26.6)	384 (100)	
Age (Months)				
≤ 2	161 (70.6)	67 (29.4)	228 (100)	0.4
>2	137(74.1)	48 (25.9)	185 (100)	
Gender				
Male	123 (70.0)	53 (30.0)	176 (100)	0.34
Female	176 (74.3)	61 (25.7)	237 (100)	
Time of blood request				
Day	193 (73.7)	69 (26.3)	262 (100)	0.37
Night	105 (69.5)	46 (30.5)	151 (100)	

Two hundred and sixty two requests (63.4%) were made at night, 151 (36.6%) during the day, while 189 (45.8%) of the transfusions occurred at night and 224 (54.2%) were transfused during the day.

None of the factors evaluated: reasons of blood request, age, gender, and time of blood request, seemed to significantly influence whether the transfusion had correct clinical indications or not (Table VI).

Table VII-Factors Influencing the Appropriateness of blood transfusion as determined using the volume of blood administered

Factor	Appropriate (%)	Inappropriate (%)	P-Value
Reasons for blood request			
Bleeding	15 (51.7)	14 (48.3)	0.02
No-Bleeding	137 (35.7)	247 (64.3)	
Age (Months)			
≤ 2	78 (34.2)	150 (65.8)	0.38
> 2	74 (40.0)	111 (60.0)	
Gender			
Male	71 (40.0)	105 (60.0)	0.43
Female	81 (34.2)	156 (65.8)	
Time of blood request			
Day	95 (36.3)	167 (63.7)	0.34
Night	57 (37.7)	94 (62.3)	
Time of blood transfusion			
Day	65 (34.4)	124 (65.6)	0.50
Night	87 (38.8)	137 (61.2)	

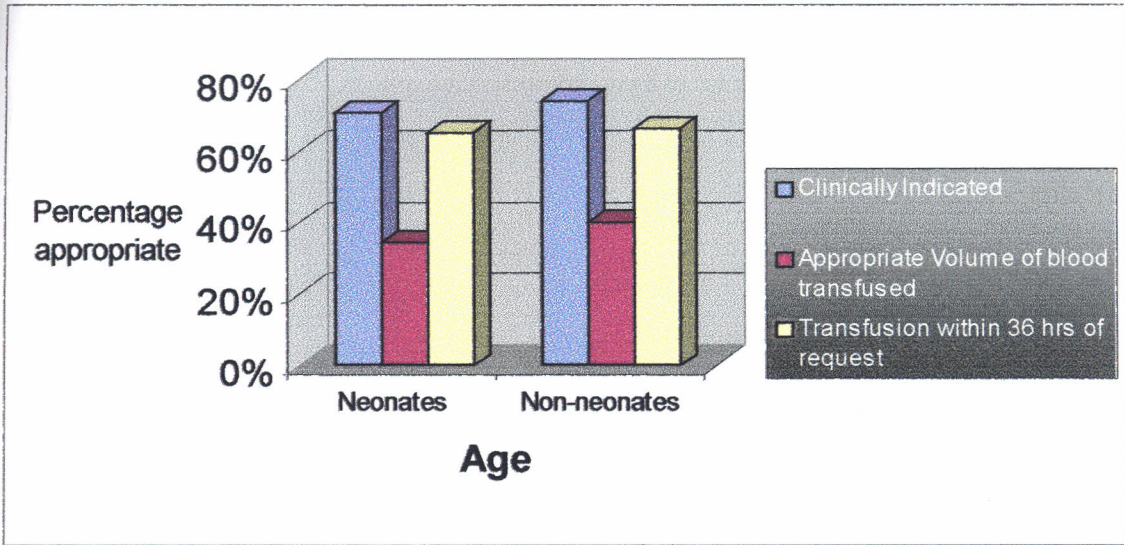
Among the factors evaluated, only reasons for blood request seemed to significantly influence the appropriateness of volume of blood transfused (P=0.02) while all the other factors (age, gender and time of blood request) had no significant influence on the appropriateness of volume of blood transfused (Table VII).

Table VIII-Factors Influencing appropriateness of blood transfusion as determined using time interval between blood request and administration

Factor	Appropriate (≤ 36 Hrs) (%)	Inappropriate (> 36 Hrs) (%)	P-Value
Reasons for blood request			
Bleeding	29 (100)	0 (0.0)	<0.01
No-Bleeding	250 (65.1)	134 (39.9)	
Age (Month)			
≤ 2	148 (64.9)	80 (35.1)	0.57
> 2	123 (66.5)	62 (33.5)	
Gender			
Male	121 (68.8)	55 (31.2)	0.32
Female	150 (63.3)	87 (36.7)	
Blood group			
O	100 (42.0)	138 (58.0)	<0.01
Non-O (A B, AB)	171(97.7)	5 (2.3)	
Time of blood request			
Day	120 (45.8)	142 (54.2)	<0.01
Night	151 (100.0)	0 (0.0)	

The most frequently transfused blood group was O (57.6%). Blood group significantly affected the time interval between blood request and transfusion ($P < 0.01$). Of all the transfusions of blood group O, only 42.0% were initiated within the appropriate time interval of 36 hours or less. Time interval was also significantly affected by reasons for blood request and time of blood request ($P < 0.01$). The other factors (age gender and time of blood request) did not significantly affect the time interval between blood request and transfusion (Table VIII).

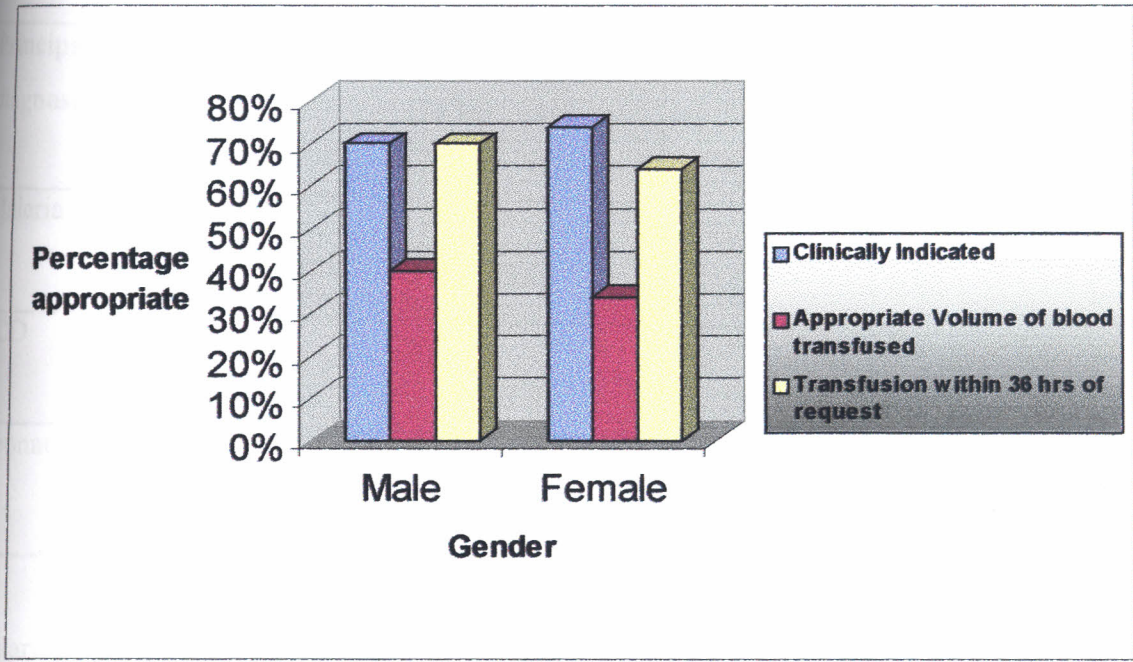
Figure II-Appropriateness of blood transfusion by age group



Age did not seem to significantly influence the volume of blood transfused ($P=0.38$), time interval between blood request and transfusion ($P=0.41$) or whether the transfusion was clinically indicated or not ($P=0.46$).

The rates of appropriateness of blood transfusion for clinical indications, volume of blood and time interval between blood request and transfusion was very similar between the two age groups (Fig II, Tables VI, VII & VIII).

Fig III- Appropriateness of blood transfusion by Gender



The rate of appropriateness did not seem to vary significantly between males and females for either clinical indications, volume of blood transfused and time interval between blood request and transfusion ($P=0.27$, $P=0.43$ and $P=0.25$ respectively)

The rates of appropriateness were very similar between the two sexes (Fig-II, tables VI, VII, & VIII)

Table-IX Overall appropriateness of blood transfusion by most common principal diagnoses

Principal diagnosis	Appropriate (%)	Inappropriate (%)	Total (%)	P-Value
Malaria	47 (37.0)	80 (63.0)	127 (100)	0.02
SCD	10 (37.0)	17 (63.0)	27 (100)	<0.01
Neonatal Sepsis	30 (17.0)	147 (83.0)	177 (100)	0.28

Malaria (plus/minus other condition) was associated with transfusion in 30.8% of the subjects followed by SCD (plus or minus other condition) 6.5%. For transfusions in children aged two months and above 68.6% were associated with malaria while 14.6% were associated with SCD making a total of 83.0% of all transfusions in children aged above two months. Neonatal sepsis (plus/minus other condition(s)) was the most common diagnosis associated with transfusion in children aged two months and below, contributing to 77.6% of the transfusions in this age group and 42.9% of the total transfusions. The three principal diagnoses combined accounted for most (80.0%) of the transfusions. Of all the appropriate transfusions, 54.0% had malaria, 11.5% had SCD and 34.5% had neonatal sepsis. The transfusion was significantly appropriate if the diagnosis was malaria (P=0.02) or SCD P<0.01). This was not the case for neonatal sepsis (P=0.28) (Table-IX).

DISCUSSION

There is currently a considerable interest in the assessment and assurance of the quality of medical care and transfusion medicine is no exception. Review of blood transfusion practices has been necessitated by the need to ensure optimal use of an expensive and limited resource, and the need to avoid exposing patients to potential risks associated with allogeneic blood transfusion therapy. This has led to development of a number of clinical practice guidelines in an effort to improve and harmonise transfusion practices. However, in spite of these standard guidelines, misuse of blood and blood components is rampant [8, 38, 43-45]. There are several factors that may hinder adherence to guidelines: the guidelines may not be easily available and when available they may be bulky and lengthy; Level of awareness may vary among clinicians; bad practices may be passed on to newly qualified doctors; in some situations, the guidelines may not be updated, or the indications for transfusion may not be very clear i.e. there may be grey areas. Guidelines vary from place to place and from patient groups to patient group and they aid but do not replace clinical judgment.

In this study, we found that the rate of appropriate use of blood was unacceptably low (21.0%). Most of the transfusion episodes were either not clinically indicated (27.8%), were either, over-/under-transfused, (63.1%) or were transfused much later than recommended (34.4%). Among the factors that were evaluated: sex, age reasons for blood request, time of blood request and time of blood transfusion, none seemed to directly influence the rates of appropriateness for clinical indication or volume of blood transfused. However, indicating that the patient was bleeding, on the request card,

seemed to significantly shorten the time interval between blood request and onset of transfusion of blood ($P < 0.01$). Time interval between blood request and commencement of transfusion seems was significantly influenced by, reasons for blood request ($P < 0.01$) blood group ($P < 0.01$), and time of blood request ($P > 0.01$) but not by age ($P = 0.86$) or gender ($P = 0.26$).

Limited data exist on the rate of appropriate use of blood in Kenya. Lacklitz in a study done in Siaya district Hospital [7] found that 47% of paediatric transfusions were inappropriate. In their study, 23% of the children did not meet the criteria of having Hb < 5 g/dl and the clinical evidence of respiratory distress and 27% of all children were transfused 2 or more days after request. The appropriateness of clinical indications was higher in this study (72.2%) than what Lacklitz found (53%). However the, appropriateness of time interval is similar to what Lacklitz found (34.0% vs. 27.0%). In their study the appropriateness of volume was not considered and this may explain why they had a much higher overall level of appropriateness compared to the findings in this study.

The rate of appropriateness for clinical indications (72.2%), though still lower than expected, was much higher than that for volume of blood transfused (36.8) and time interval between blood request and transfusion (65.5%). It may be possible that clinicians are more aware of the clinical indications for blood but may not be aware that for a transfusion to have appropriate clinical outcome, it has to be also appropriate in volume transfused and in timeliness. Lacklitz [18], also echoed the need for taking into account both clinical and laboratory parameters when considering the appropriateness of a blood

transfusion. In their study, clinically stable patients without evidence of respiratory distress had only a small risk of dying irrespective of the haemoglobin level at admission. The rate of appropriateness for clinical indications is much higher in this study than in the other studies [7,18-19]. This fact may have occurred since these studies were conducted in district hospitals, while the current study was conducted in a tertiary care hospital. A few factors may have contributed to the sub-optimal rate of appropriateness for clinical indications. There may have been over-reliance by the physicians on laboratory results alone, lack of re-evaluation of the children to determine if the transfusion was still needed even for those children transfused five days later when the clinical signs may have changed. It is also hard to attribute the clinical signs of cardio-respiratory embarrassment purely to the anaemia alone, since the underlying illness may make the child haemodynamically unstable and treatment of such illness may improve the child's state nullifying the need for transfusion.

Volumes of blood transfused varied widely with only 36.8% of the subjects being transfused with appropriate volume. According to the KNG-AUBTS, the pre-transfusion Hb is not taken into consideration and the volume depends on the body-weight alone; this means that a child weighing 10kg with a haemoglobin level of 2g/dl, and another of the same weigh and a haemoglobin level of 6g/dl, will be transfused with the same volume [200mls]. The volume of blood transfused ranged from 8mls/Kg to 62 mls/Kg . It is hard to explain this wide range but its possible that most doctors may have considered the level of pre -transfusion Hb and not just the weight of the children. Studies on appropriateness of volume are scanty; Lackritz et al in their studies [7,28-19], did not consider the appropriateness of volume of blood transfused. It is then hard to compare the

appropriateness of the volumes transfused. Pre-determined volume is may not always be transfused, rather the volume of blood transfused can be titrated against the clinical signs [40]. Owiti [37] working at KNH had raised concerns of wastage of blood since there were no paediatric packs and 44% Of the patients received volumes less than 250mls. In this study, apart from over transfusion, most patients received an average of 161 mls. This shows that paediatric patients receive very small volumes of blood and there should be serious consideration of availability of paediatric blood bags with a view to reducing wastage, which would translate into an increase in blood availability.

The KNG-AUBTS is not clear on how soon blood should be transfused but states that blood transfusion improves survival if given immediately at the time it is needed. Other studies [7,18-19] have demonstrated that the benefit of transfusion was limited to the day of admission or the next (approximately 36 hrs). These studies [7,18] emphasized on the importance of timing of transfusion as a key indicator for beneficial transfusion. In their study, transfusion was only associated with decreased mortality if given during the first two days of admission. For the purpose of our study “immediately” was taken as 36 hours. Only 26% of the transfusions were given within the day of admission/request- If a more stringent cut-off of 12 hours was used, then the rate of appropriate time interval would have fall from 65.6% to 26.2%. This would then be much lower than Lackritz ‘s findings of 73% [7,18], though twelve ours is not evidence based hence the two are not comparable. In this study, other factors such as blood group, reasons for blood request and time of blood request, seems to have influenced the time interval between blood request and transfusion on top of blood availability. It is not clear from this study when

blood would be of maximum benefit since assessment of the of the transfusions was not the aim of this study.

This study is not different from other studies done in Africa [7-8, 18-19,39] in the appropriateness of time interval between blood request and transfusion This delay in transfusion has been found to result from dependence on relatives to donate blood [39], which means that valuable time is lost before the blood is collected, screened and transfused. Since blood availability is limited, early treatment and prevention of paediatric anaemia would help in reducing the need for transfusion. In the current study, malaria was found to be the commonest principal diagnosis (30.8%) associated with blood transfusion. Appropriate and timely treatment of malaria would be expected to have an impact on reducing the need for transfusion.

Modern care has resulted in increased survival of preterm neonates hence the increasing need for transfusion. Over half of study subjects (55.2%) were from Newborn Unit (NBU). The rates of appropriateness for clinical indications, volume of blood transfused and time interval between blood request and transfusion were similar in both neonate and the older child unlike in other studies [8] which found higher rates of inappropriate use in the younger age groups.

Most studies on appropriateness of blood transfusion [11,17,43-45] have been retrospective, while current study was prospective. Comparing the value of a retrospective study with a prospective study is hard. In a retrospective study, the decision to transfuse may have been made based on observation or condition that was not well documented on the patient's chart thus falsely increasing the percentage of unnecessary

transfusions. In a prospective study all the clinical signs were noted while in retrospective studies, one might not have the benefit of verifying the condition. In our study the patient's condition was always verified.

From these results it can be concluded that the rate of appropriateness of blood transfusion for paediatric patients at KNH is unacceptably low. The appropriateness of blood transfusion is mainly affected by the volume of blood transfused with only 36.8% of the transfusion having appropriate volume. The other factors, clinical indications (72%) and time interval between blood request and transfusion (65.6%), though better are still way below the expected. It is clear then that the guidelines, which should be used, are not in use. This should be enforced for better outcomes. It is also important to assess the influence of the knowledge of clinicians, on the appropriateness of blood transfusion. not only on clinical indications but also on timeliness of transfusions and appropriate volumes of blood. One also needs to ascertain what influences the availability of blood, is it purely lack of blood or do other factors come into play.

Conclusion

- 1) Using the Kenya National Guidelines for the appropriate Use of blood, this study has demonstrated: the rate of appropriate use of blood for children admitted at KNH is very low. Most transfusions did not meet the criteria for appropriate transfusion. Some transfusions not clinically indicated, a good number of children were over-/under-transfused and others were transfused much later than the recommended time. The most affected factor was volume of blood transfused.
- 2) Over-transfusion is a common practice in paediatric transfusions at Kenyatta National Hospital.
- 3) Appropriateness of time interval between blood request and transfusion may not be determined by blood availability only but also by other factors such as patient's blood group, reason for blood request and time of blood request.

Recommendations

- 1) There is need to design educational programs for the staff on appropriateness of blood transfusion, in terms of clinical indications, volume of blood transfused and timeliness of transfusion episodes, if the benefits of transfusion have to be realized.
- 2) Guidelines should be enforced and disseminated to all areas of clinical services where they can easily be available to blood product prescribers. The guidelines will require further refinement and clarity especially in the area of time interval blood products.

Dissemination of results

The results of the study will be distributed to the university library and Department of Paediatrics and Child health. The blood transfusion committee at KNH will also be informed of the results. Efforts will be made to inform all clinicians that prescribe blood for paediatric patients by display charts in the paediatric wards.

Study Limitations

- 1) The time of blood request was not recorded in some situations and the requesting doctor had to “recall” which may have not been the exact time.
- 2) Defining the appropriate time interval between blood request and commencement of transfusion was not possible from the guidelines and hence the decision to use ‘36’ hours cut off from findings in previous studies.
- 3) It was not possible to find out the influence of mode of admission on appropriateness of blood transfusion since all children were admitted as emergency.
- 4) The neonatal period was taken as 0-2 months for the purpose of this study in order to be able to apply the guidelines.
- 5) Children for who blood was requested and not actually transfused were not followed up.

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Appendix-I
PROFORMA SHEET

BLOOD TRANSFUSION PRACTICES IN CHILDREN ADMITTED
AT KENYATTA NATIONAL HOSPITAL, KENYA.

Demographic data

01 Case Number

02 IP Number

03 Ward

04 Age (In month up to 60 months, then in years.)

05 Sex

06 Body Weight (Kg)

Clinical Data

01 Admission/Principal diagnosis

02 Indication for transfusion

Laboratory Data

01 Hb/PCV-(g/dl / %)

02 PT/APPT/INR

03 PLT Count (, /mm³)

04 Others (Specify)

Physical Exam

- 01 HR (beats/min)
- 02 RR
- 03 Hepatomagally
- 04 Gallop rhythm
- 05 Bleeding (+/-)
- 06 Others (Specify)

Transfusion Data

- 01 Volume of blood requested for (mls).
- 02 Actual Volume Transfused (mls).
- 03 Ideal volume (mls)
- 04 Date and Time of request
- 05 date and time of transfusion
- 06 Time Interval (Hours)

07 Degree of urgency Desperate

Urgent

Non-urgent.

Transfusion appropriateness

Is the transfusion appropriate in

- 01 Clinical indication?
- 02 Timing?
- 02 Volume?

Appendix-II

SUMMARY OF KENYA NATIONAL GUIDELINES FOR APPROPRIATE USE OF BLOOD AND TRANSFUSION SERVICE (KNG-AUBTS)

Blood must be transfused only when required to save a life. A decision to transfuse must be based on BOTH the haematological AND clinical status of the patient. The decision to transfuse should be based on an estimate of the patient's risk for developing inadequate tissue delivery. Studies have shown that blood transfusion improve survival if given at the time it is needed.

RBC transfusion is rarely indicated when haemoglobin levels are greater than 10g/dl, and may be indicated when Hb, concentrations are <5g/dl. Patients who are severely anaemic, Hb <5g/dl, who are clinically stable may not require transfusion.

A patient should be re-evaluated clinically when blood is available to make sure that they still require transfusion.

Guidelines for paediatric transfusions

If Hb <4g/dl, transfuse

If Hb 4-5g/dl, transfuse when signs of respiratory distress or cardiac failure present

If Hb 4-5 g/dl, and clinically stable, monitor closely and treat the cause of anaemia.

If Hb >5g/dl, transfusion is usually not necessary. Consider transfusion if in shock or sings of CCF not attributable to other clinical conditions.

References for acceptable heart rates and respiratory rates

Age (Months)	Heart rate (Beats/Minute)	Respiratory Rate(Per minute) (Cut off used)
0-2	70-190	60
>2-12	80-160	50
>12-60	80-120	40
>60	70-110	30

For congenital anaemias like SCD, the aim should be to relieve signs of decompensation but not to normalize the Hb.

Indications of blood transfusion in SCD

1) Acute transfusion

Symptomatic anaemia, Complicated painful crises not relieved by medical therapy, Aplastic crises, Splenic sequestration, Accelerated haemolysis.

2) Chronic transfusion

Prevention of recurrent occlusive stroke

Neonatal blood transfusion guidelines

Transfuse with 10-15 mls of PRBCs for:

Haemoglobin <7g/dl

Hb <8g/dl in newborns with apnoea, bradycardia, tachycardia or decreased vigour.

Hb<12 with respiratory distress syndrome, or congenital heart disease, or absence of weight gain for 7 days without any other identifiable cause of failure to gain weight.

Hb <13g/dl on day one of life.

Appendix-III

CONSENT FORM FOR PARTICIPATION IN THE STUDY

Study Title: Blood transfusion practices in children admitted at Kenyatta National Hospital

Investigators

Dr. Wahu Gitakah R, Postgraduate student, University of Nairobi

Dr. Kariuki Nyambura, Supervisor, Senior Lecturer University of Nairobi

Prof Macharia M.N, Supervisor, Associate professor of paediatrics and child health, University of Nairobi.

Investigators' Statement

We are asking you and your baby to participate in a research study. The purpose of this consent form is to give you information you will need to help you decide whether to participate in the study. Please read this form carefully. You may ask about the risks or benefits to you or to your baby.

Introduction

Blood transfusion is a life saving procedure. However, in few instances it may be associated with some risks. Blood is also not readily available. In order for the doctor to know who is most likely to benefit from a blood transfusion, the ministry of Health has laid out guidelines as to reduce unnecessary transfusions. Our study Sets out to see if the guidelines are still being followed in an effort to collect practices that fall short of the guidelines

The benefits of the study

The investigator will be available to answer any questions that may arise during the study period. You may not benefit directly from the study but your participation will help the doctors correct their habits that may be deviating from the set guidelines.

The risks

There are absolutely no risks involved in participating in the study. Your child will not be denied any treatment by participating in the study. There are no invasive procedures involved hence no harm to your baby.

Information about confidentiality

All information will be held in strict confidence. No information will of any kind will be released to any other person or agency without your permission expressed in writing. We will publish or discuss in public the study but not anything that could identify your baby or you. No penalty will be held against you if you so wish to withdraw from the study.

Do you have any questions? YES.....NO.....

Do you agree to participate in the study? YES.....NO.....

Investigator's signature_____

Investigator's name_____

Subject's Parent/guardian

The study described above has been explained to me. I agree my baby to participate in the study. I had a chance to ask questions about the research to which satisfactory answers were given. I have further been assured that if I have future questions about the research or my rights and those of my baby/child, I am free to ask the investigator. I also understand that I am free to withdraw from the study without any penalty.

Parent/Guardian

Printed name

Date

Left thumb print _____

Date _____

Witness signature/thumbprint _____

Date _____

Cc: Subject's file

Investigator's file