The persistent and urgent need for blood in Africa

The distribution of blood transfusions at a district hospital in Malawi

A cross-sectional study at Mangochi District Hospital, Malawi

by

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Abstract: The persistent and urgent need for blood in Africa

Objective:
This cross-sectional study sought to give a record of all the blood transfusions conducted at a local hospital in Mangochi, Malawi during three weeks in January 2010.

Materials and methods:
Blood transfusion is an important and life-saving treatment in patients with acute severe anemia. By looking through the log book at the laboratory, all blood transfusions were recorded with information about age, gender, Hb level, diagnosis, department and origin of the blood. All patients admitted at the hospital who received a blood transfusion during the study period was included.

Results:
The mean Hb in the total study population was 4.8 (95% confidence interval =1.2-8.4). The median age of female patients receiving blood transfusions was 3.0 years (IQR=1.0-24.1) and the median age of male patients was 2.0 years (IQR=1.0-4.0). Two thirds (65/104) of the patients included in the study were under five years of age. More than half of the blood transfusions were given to patients diagnosed with malaria, and 93% of these were pediatric patients.

Discussion:
The findings indicate that the youngest children with malaria and pregnant women are the patients most frequently to require blood transfusions. The results indicate that the health care providers adhere to the current guidelines for blood transfusion, and highlight the need for local adjustments of adequate and safe blood transfusion services. Further studies are needed to explore the need for and organization of sustainable and safe blood transfusion services in resource-limited settings.
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INTRODUCTION

Severe anaemia is an important cause of morbidity and mortality in sub-Saharan Africa\textsuperscript{1,2}. Nearly 700 000 African children die of anaemia due to malaria every year; close to half of all under-five mortality in the world\textsuperscript{3-5}. The maternal mortality in Africa is equally the highest in the world at an average of 1000 per 100 000 deliveries, of which up to 40 \% are attributable to haemorrhage\textsuperscript{4,6,7}. Malnutrition, helminth infections, HIV infection, road traffic accidents and haemoglobinopathies are additional causes of severe anaemia in sub-Saharan Africa\textsuperscript{1,8}.

Adequate and well-functioning blood transfusion services are life-saving for patients presenting with acute severe anaemia\textsuperscript{9,10}. However, in spite of the urgent and widespread need of blood transfusions in African health care facilities, there are few reports of the use and distribution of blood transfusions in the region\textsuperscript{4}. The WHO has called for day to day data collection from blood transfusion units to improve the transfusion services at the facility level as well as to ensure accurate national and regional data\textsuperscript{4}.

The aim of this study is to provide an account of the use and distribution of blood transfusions at a district hospital in rural Malawi.
MATERIALS AND METHODS

Study site

The study was conducted at Mangochi District Hospital (MDH) situated at the southern end of Lake Malawi (Figure 1). Mangochi district is a rural region of Malawi with a population of more than 600,000. MDH houses a total of 240 patient beds, with a staff of 1 doctor, 8 clinical officers and approximately 30 nurses. (Bendabenda, personal communication). The hospital consists of five separate departments for male, female, paediatric, maternal and post-natal services respectively. Annually, close to 150,000 patients are admitted for treatment.

![Figure 1. The study site. Mangochi district is located at the southern end of Lake Malawi.](image)

Although nearly 90% of Malawi’s workforce is employed in agriculture, close to twenty per cent of children younger than five years old are severely undernourished\(^{11,12}\). Mangochi district is a high-endemic area for malaria transmission, with infection rates peaking during the rainy season from December to May\(^5\). Eighty per cent of the country’s population is Christian, and approximately 13% are Muslim\(^{13}\). The HIV prevalence among adults aged 15 to 49 years is estimated to be 11%\(^{14}\).
**Blood transfusion services**

The hospital’s blood bank received blood units either provided from the national Malawi Blood Transfusion Service (MBTS) or through the hospital-based system. The blood units that originated from the hospital-based system were either collected from local non-remunerated volunteer donors or from a replacement donor at the time of transfusion. The only blood product applied for transfusions at the hospital during the study period was whole blood.

When a blood transfusion is required for one of the hospital’s patients, an ethylene diamine tetraacetic acid (EDTA) tube containing the recipient’s blood is sent to the laboratory attached to a blood transfusion request form. The blood sample and form are labelled with the current date and the recipient’s name and ward. The results of the grouping of the recipient’s blood and cross-matching results are recorded on the blood transfusion form. If a potential donor is identified, the blood from the donor is drawn to fill an EDTA tube and a blood unit bag equipped with a donor identification number, the current date and estimated expiry date. The blood in the EDTA tube is used to measure the Haemoglobin (Hb), and for screening, grouping and cross-matching.

**Laboratory procedures**

Hb was measured by HemoCue® Hb 201, and malaria was diagnosed by thick and thin blood smears with Field’s stain and microscopy. The diagnostics were performed by experienced laboratory technicians under the supervision of the district health officer. All blood units were screened with rapid tests for human immunodeficiency virus (HIV) 1 and 2, Hepatitis B, Hepatitis C and syphilis using Determine® 1/2, Determine® HBsAg, SD Bioline HCV and Determine® Syphilis TM, respectively. The blood used for screening was kept in BD Vacutainer® EDTA tubes. Donor blood was drawn to either Medikit® Medibag 450 mL, Jierui Blood Bag 450 mL or HL Haemopack 250 mL.
Data collection

A cross-sectional study was performed during the first three weeks of January 2010. All patients who received blood transfusions during the study period and who gave free, informed consent to participate in the study, were included. All patient data were anonymised using a random identification number, and were registered and stored securely. Patients consulting the out-patient department were not included in the study as they did not receive blood transfusions. Mortality rates were not registered as part of this study.

All blood transfusions at the hospital during the study period were registered in a laboratory log book. The age, gender, Hb level, diagnosis, department and origin of the blood unit were recorded for each transfused patient. The Hb was registered at the time of request for blood transfusion, and the diagnosis was given by the clinical officer. “Anaemia” was defined as Hb < 11.0 g/dL in children younger than five years old and pregnant women, Hb < 11.5 g/dL in children younger than 12 years old, Hb < 12.0 g/dL in children younger than 15 years old and non-pregnant women and Hb < 13.0 g/dL in men\(^1\).

“Malarial anaemia” was defined as patients presenting with symptoms and signs of malaria who had anaemia and a positive blood smear for malarial parasites. “Surgical cases” were defined as patients presenting with a surgical diagnosis and anaemia, and “pregnancy-related anaemia” was defined as patients presenting with an obstetrical diagnosis and anaemia. “HIV-related anaemia” was defined as patients with laboratory-verified HIV infection and anaemia of no apparent cause other than HIV. Anaemic patients without a certain diagnosis were categorised as “Other anaemia”.
Ethical considerations

The study was granted permission by the hospital’s ethics committee. Following free, informed consent, anonymised patient data were included in the study. The data registration did not in any manner interfere with patient diagnostics or treatment. All blood units used for transfusion were screened for HIV, HBV, HCV, syphilis and malaria, and diagnostics, treatment and follow-up were taken care of by the local health care professionals.
RESULTS

During the study period, an estimated 8600 patients were admitted to the hospital, and of these 1.2% (104/8600) received blood transfusion. Fifty-eighth per cent (60/104) of the total study population were females, whereas 55% (36/66) of the paediatric patients were male. The median age of female patients receiving blood transfusions was 3.0 years (interquartile range (IQR)=1.0–24.1) and the median age of male patients was 2.0 years (IQR=1.0–4.0). As shown in Figure 2, nearly two thirds (65/104) of the patients included in this study were under five years of age.

Figure 2. The age distribution of patients included in the study.
Diagnosis and ward distribution

More than half of the blood transfusions were given to patients diagnosed with malaria (Figure 3), and 93% (55/59) of these were paediatric patients. Sixty-four per cent (66/104) of the blood units were given at the paediatric ward, whereas 29% (30/104) and 8% (8/104) of the blood transfusions were given in the adult female and male wards respectively.

Figure 3. The distribution of diagnoses among transfused patients at MDH.

Haemoglobin levels

Figure 4 shows the distribution of Hb levels in patients who received blood transfusion. The mean Hb in the total study population was 4.8 (95% confidence interval (CI)=1.2–8.4). The mean Hb among paediatric patients receiving blood transfusion was 4.4 (95% CI=1.4–7.4), whereas the median Hb in the adult study population was 5.6 (IQR=3.9–6.7).
The mean Hb of transfused children younger than three years old was significantly lower than the mean Hb of children older than three years (Odds Ratio (OR)=1.29, 95% CI=1.03-1.63, p=0.029). The Hb of paediatric patients who were transfused was significantly lower than the Hb of adult patients requiring transfusion (p=0.049). There was no difference in Hb levels between sexes. The Hb of patients requiring blood transfusions due to malaria or “other anaemia” was significantly lower than the Hb of patients suffering from other diagnosis (p<0.001 and p=0.032 respectively).

Figure 4: The distribution of Hb levels in patients who received blood transfusion.
Origin of blood units

Figure 5 shows that a large number of blood units for transfusion were collected from replacement donors, however, possibly to a lesser extent in patients being transfused due to HIV infection (figures are low). Further, the mean Hb values for patients transfused with blood units from the blood bank was not significantly different from the Hb levels of patients receiving blood drawn from a replacement donor. (OR=1.11, 95% CI=0.89-1.38, p=0.36).

Figure 5: The origin of blood units relative to diagnoses in transfused patients.
DISCUSSION

This study provides a day to day account of blood transfusions at a district hospital in Malawi. Acute severe anaemia is a frequent cause of hospital admissions in sub-Saharan Africa, and adequate blood transfusion services are critical to life-saving treatment in these patients\(^9,10\). In line with previous studies, the findings indicate that the youngest children are most susceptible to severe anaemia and that malaria is the main cause of patients in need of blood transfusions\(^8,16,17\). In addition to the findings in this study, Malawian children may be prone to severe anaemia in need of transfusion due to malnutrition, bacteremia, helminth infections and various genetic disorders\(^8\).

Pregnancy-related anemia is the most common reason for blood transfusion in an adult female admitted to the hospital. Haemorrhage due to obstetrical complications is the leading cause of maternal mortality in Africa\(^6,18\). Interventions to reduce maternal mortality include preventive measures such as skilled birth attendance and emergency obstetric care\(^19,20\). In addition, rapid access to safe blood transfusions is essential to reduce maternal mortality in African women\(^21,22\).

Patients infected with HIV frequently develop anaemia and may require blood transfusions\(^21-26\). HIV-associated anaemia is of multifactorial origin, and possible causes may include opportunistic infections, malnutrition, AIDS-associated malignancies, medications or virus-induced alterations in haematopoeisis\(^27\). Less than three per cent of the transfusions were administered to HIV infected patients in this HIV endemic region\(^14\). HIV is associated with considerable stigma, and thus health care professionals were led to use the term “chronic illness” as a reference to HIV infection, or to use other diagnoses when possible (Chisuwo, personal communication). This might suggest that blood transfusions due to HIV infection were in fact higher than our data indicates.

This study has several limitations. The study period is short and the cross-sectional design does not permit conclusions concerning causality. The data was collected from the laboratory log book, and diagnoses were set by the clinical officers and in some cases by the medical doctors. No control of
transcription of diagnoses to the laboratory log book was performed, making the registration prone to human errors. Experienced and well-educated health care professionals had limited diagnostic tools to aid the clinical diagnoses of the patients. While malaria, HIV, hepatitis and syphilis were diagnosed using validated diagnostic tests, diseases such as malnutrition, bacteremia, helminth infections and genetic disorders were not routinely laboratory-verified. These diagnoses might have been categorised as “anaemia of unknown reason”, and might explain why our study did not identify any of these diagnoses.

In this study, patients were in average transfused at a average Hb of 4.8. Although the study did not include clinical evaluation of the blood transfusions, the findings could indicate that the hospital follows suggested guidelines for blood transfusions in resourced-limited settings. Previously, the effect of implemented guidelines on avoidable blood transfusions has been evaluated. Regular clinical meetings and strict supervision by senior medical staff were, alongside implementation of guidelines, identified as vital factors to reduce avoidable blood transfusions.

In this study, nearly half of all blood units used for transfusion were drawn from replacement donors. Reports raise the concern of increased risk of transfusion transmissible diseases from family replacement donors, and the WHO recommends collection of blood only from voluntary non-remunerated blood donors from low-risk populations. In Malawi, decentralised hospital-based blood banks are supplemented by blood provided by the national Malawian Blood Transfusion Service (MBTS). Adequate and safe blood transfusion services are costly to develop, organise and maintain, and reports indicate that local adjustments are necessary for their successful management and sustainability.

In conclusion, this study provides a day to day account of blood transfusions given at a rural hospital in sub-Saharan Africa. The findings indicate that the youngest children with malaria and pregnant women are the patients most frequently to require blood transfusions. The results indicate
that the health care providers adhere to the current guidelines for blood transfusion, and highlight the need for local adjustments of adequate and safe blood transfusion services. Further studies are needed to explore the need for and organisation of sustainable and safe blood transfusion services in resource-limited settings.
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