

Utilisation of emergency blood in a cohort of emergency centres in Cape Town, South Africa

by

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Abstract

Background

The transfusion of blood and blood products forms an essential part of the resuscitation of patients with acute haemorrhage. Group O blood is stored for this purpose in many emergency facilities and transfused uncrossmatched at physician discretion. Minimal data are at present available to describe this practice, particularly the indications for which emergency blood is transfused and the volume thereof.

Objectives

This study aimed to describe the indications for which emergency blood was utilised in selected emergency centres in the Cape Town Metropole. Volumes were also noted. Practice at secondary level emergency centres was compared with the tertiary Groote Schuur Hospital.

Methods

A cross-sectional study was carried out at three secondary level emergency centres and a tertiary hospital. Data from all recipients of emergency blood from the emergency centre blood reserve were recorded in study registers over the three month study period. The indications for transfusion, volume of blood in units and location of transfusion were recorded. Indications were described as categorical variables and reflected as proportions.

Results

Over the three month study period a total of 329 units of emergency blood were transfused to a total of 210 patients. Haemorrhage as a result of trauma accounted for 39% (n=81) of the cases for which emergency blood was used. This was followed by surgical conditions at 22% (n=47), particularly upper gastrointestinal bleeding 11% (n=24) and perioperative bleeding 8% (n=16). Medical conditions accounted for 15% (n=31) of the blood, with anaemia, 13% (n=27) the most prevalent, particularly at the secondary level hospitals. Gynaecological conditions required 15% (n=32) of the total, particularly ectopic pregnancy 8% (n=17). The majority of emergency blood, 77% (n=253) was used in the emergency centres and trauma unit, followed by the operating theatres at 6% (n=21).

Conclusion

Trauma was the most frequent indication and accounted for the greatest volume of emergency blood transfused. Upper gastrointestinal bleeding, early pregnancy complications and anaemia were the next most common indications. Perioperative bleeding was the most common reason for emergency blood to be used outside of the emergency centre. Ongoing monitoring of this resource is recommended.

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Introduction

The historical and philosophical association between blood and life is borne out in the critical role that blood and blood products play in modern haemostatic resuscitation. Early use of blood and the limitation of the use of crystalloid fluids have shown significant mortality benefit in the critically injured as well as those with haemorrhage not related to trauma. (1-5) The most common preventable cause of death in trauma patients remains haemorrhage and blood is often needed to replace a proportion of the blood that is lost. (6)

In the Cape Town Metropole, public patients undergo their initial resuscitation and investigation in emergency centres at a number of secondary and three tertiary level hospitals. Only the three tertiary hospitals have 24-hour staffed blood banks to provide direct access to blood and blood products. The remaining hospitals are provided with a modest supply of Group O blood to be transfused as uncrossmatched emergency blood until crossmatched blood can be obtained from the nearest blood bank, or the patient is transferred to a facility with a blood bank on site. To accommodate the lack of a 24-hour staffed blood bank, emergency blood is stored in dedicated fridges in strategic areas of these hospitals, typically the emergency centre, labour ward or theatre. These fridges are stocked by the Western Cape Blood Transfusion Services according to predetermined levels of anticipated use (written communication, 18 September 2014). Emergency blood is transfused at the discretion of the treating physician. There are at present no formal guidelines directing the use of this resource and, anecdotally, wide variations in local circumstances and patient presentations exist.

While doctors are required to complete request forms for the use of crossmatched blood from the blood bank, the same process is not followed for emergency blood, as the blood is immediately at hand and record keeping is therefore less robust. The result is that whilst blood taken from the fridge for emergencies can usually be traced to whom it was transfused, there are little data on the indications for which this costly and limited resource is being utilised. Without this data it is difficult to define a reference standard regarding its use in emergency situations. There is currently little accountability for inappropriate use, despite the unnecessary risk and cost resulting from uncrossmatched transfusions using emergency Group O blood. (7-11)

Understanding the way emergency blood is utilised may provide the first step towards implementing local guidelines that will encourage safe and effective use of emergency blood. Our study aimed to address this information gap by describing the utilisation of emergency blood in a cohort of emergency centres in the Cape Town Metropole. The main objective was to determine the indications for which emergency blood was transfused in the emergency centres of three secondary level hospitals and one tertiary hospital.

Methods

A cross-sectional study was conducted from 1 August 2016 to 31 October 2016. Ethics approval was obtained from the Stellenbosch University Health Research Ethics Committee and additional permission to collect data at the specific study sites was obtained from the Western Cape Provincial Health Research Committee. Data from the blood bank at Groote Schuur Hospital was supplied with the consent of the Western Province Blood Transfusion Service.

The setting included the three public secondary level hospitals in the Cape Town Metro West drainage area; New Somerset Hospital, Mitchell's Plain Hospital and Victoria Hospital and the tertiary Groote Schuur Hospital. These hospitals serve the western part of the city of Cape Town as well as some of the surrounding suburbs and informal settlements. The private hospitals in this area were not included for logistical reasons.

Subjects included from the secondary hospitals were patients that were administered emergency blood from the blood fridge in the emergency centre, whilst subjects included from the tertiary hospital were all patients that were administered emergency blood from the staffed blood bank at Groote Schuur Hospital. Groote Schuur Hospital does not have a single emergency centre model, but receives and stabilises patients in several separate areas, hence a respective emergency centre population could not clearly be defined. Of the secondary hospitals, Mitchells Plain Hospital has a blood fridge in the emergency centre, labour ward and theatre; New Somerset Hospital has a fridge in the emergency centre and labour ward and Victoria Hospital has a fridge in the emergency centre only. As the study was emergency centre focussed, data from the labour ward or theatre were not collected, unless patients in labour ward or theatre required blood from the emergency centre fridge. The converse, that blood from the labour ward or theatre be used for a patient in the emergency centre, is not practised at either of the relevant facilities. Data collection was set for a three month period detailed above and all data collected during that time were included.

Data were collected at the participating secondary level emergency centres by means of bespoke study registers which were created specifically for the study and were distributed by the study team, to be kept at the emergency blood fridges. Staff were familiarised with the correct use of the registers and regular follow-up telephone calls and site visits were used to encourage compliance in data collection. Variables collected included the indication for which blood was transfused, the location of the patient at the time the transfusion was initiated, the number of units transfused and the age and gender of the patient. Incomplete data were supplemented from patients' electronic hospital records. Conversely, at the tertiary hospital blood is obtained directly from the blood bank, making the same strategy impractical. The blood bank provided records of all emergency blood issued during the study period and included the same variables as for secondary hospitals, except for the indication which is not captured in their records. To obtain the indication for which the emergency blood was required, patients' electronic hospital records were reviewed.

Data were captured in Excel 2013 spreadsheets (Microsoft Office, Redmond, USA) and were analysed using Stata version 14 (StataCorp LLC, College Station, USA). Demographic details were calculated for the study population as a whole. Age was calculated as a mean with standard deviation and gender was directly compared. A transfusion episode was defined as a discrete clinical event or presentation for which a participant was transfused emergency blood. This may have included multiple units of emergency blood. In rare cases where a single participant had more than one separate transfusion episode during the study period, these were counted separately. ICD-10 codes were not used to describe indications as these were generally not available to the staff completing the study register at the time of transfusion. Indications were divided into the categories trauma, surgical, gynaecological, obstetric and medical, with each category containing further subcategories to better describe the sample. The number of transfusion episodes were calculated for each indication, and for the categories these were divided into. The number of units of emergency blood were also calculated for each indication, as were the mean number of units per transfusion episode for each indication. Given the small numbers a measure of spread was not calculated. To reflect differences between the various hospitals the frequency of transfusion for the major categories at each hospital were individually calculated and represented as a bar chart. Finally the total number of units per hospital location were calculated, to reflect where in the hospital the emergency transfusions are being initiated.

Results

A total of 329 units of emergency blood were transfused to 210 patients over the three month study period. Of these, 141 transfusion episodes occurred at the secondary hospitals: Mitchells Plain Hospital n=70 (33%), New Somerset Hospital n=53 (25%) and Victoria Hospital n= 18 (9%), and at the tertiary Groote Schuur Hospital n=69 (33%).

Age and gender data for each indication category group are reflected in table 1 below.

Table 1: Age and gender for each category of indications

	Mean age in years (SD)	Male n (%)	Female n (%)
Trauma	33 (13,8)	69 (85)	12 (15)
Surgical	56 (16,8)	29 (62)	18 (38)
Gynae	29 (6,7)	0	32 (100)
Obstetric	29 (7,3)	0	10 (100)
Medical	44 (21,8)	16 (52)	15 (48)
Unknown	53 (17,1)	3 (38)	5 (62)

The indications for which emergency blood was transfused as well as the volumes have been represented in table 2.

Indication categories	Secondary hospitals			Tertiary hospital		
	Transfusi on episodes n (%)	Units n (%)	Units/ episode	Transfusi on episodes n (%)	Units n (%)	Units/ episode
Total	141	186	1,3	69	143	2,0
Trauma	36 (26)	58 (31)	1,6	45 (65)	96 (67)	2,1
Gunshot abdomen	1	1	1,0	1	3	3,0
Gunshot chest	1	1	1,0	4	9	2,3
Gunshot head	1	1	1,0	1	2	2,0
Gunshot limb	1	2	2,0	0	0	-
Multiple gunshots	1	1	1,0	6	11	1,8
Multiple stabs	7	12	1,7	3	5	1,7
Stab abdomen	0	0	-	1	1	1,0
Stab chest	14	20	1,4	9	23	2,6
Stab heart	2	5	2,5	0	0	-
Stab neck	1	3	3,0	3	7	2,3
Stab limb	2	4	2,0	1	1	1,0
Blunt assault	3	4	1,3	2	4	2,0
Road traffic polytrauma	2	4	2,0	14	30	2,1
Surgical	38 (27)	49 (26)	1,3	9 (13)	15 (10)	1,7
Upper gastrointestinal bleed	20	25	1,3	4	7	1,8
Peri-operative bleeding	13	16	1,2	3	5	1,7
Acute abdomen	3	4	1,3	1	2	2,0
Malignancy	1	1	1,0	1	1	1,0
Bowel obstruction	1	3	3,0	0	0	-
Gynaecological	29 (21)	39 (21)	1,3	3 (4)	4 (3)	1,3
Ectopic pregnancy	17	26	1,5	0	0	-

Miscarriage	6	6	1,0	0	0	-
Gynaecological not specified	5	5	1,0	3	4	1,3
Abnormal uterine bleeding	1	2	2,0	0	0	-
Medical	30 (21)	32 (17)	1,1	1 (1)	1 (1)	1,0
Anaemia	27	29	1,1	0	0	-
Haemoptysis	2	2	1,0	1	1	1,0
Medical not specified	1	1	1,0	0	0	-
Obstetric	4	4	1,0	6 (9)	15 (10)	2,5
Postpartum haemorrhage	4	4	1,0	0	0	-
Obstetric not specified	0	0	-	6	15	2,5
Unknown	4 (3)	4 (2)	-	5 (7)	12 (8)	-

At Mitchells Plain Hospital 89 units of blood were used: all blood dispensed from the emergency centre blood fridge was used in the emergency centre. At New Somerset Hospital 74 units of blood were used: 47 (64%) were used in the emergency centre, 15 (20%) in theatre, 5 (7%) in the surgical ward, 3 (4%) in the labour ward and one unit in the medical, paediatric, gynaecology and ICU wards each. At Victoria Hospital 23 units of blood was used: 17 (74%) were used in the emergency centre, 5 (22%) in theatre and 1 (4%) in the surgical ward. At Groote Schuur hospital 143 units of emergency issue blood were issued from the blood bank: 100 (70%) were used in the trauma centre, 15 (11%) in the labour wards, 10 (7%) in the surgical wards and 18 (12%) in a number of unspecified general wards.

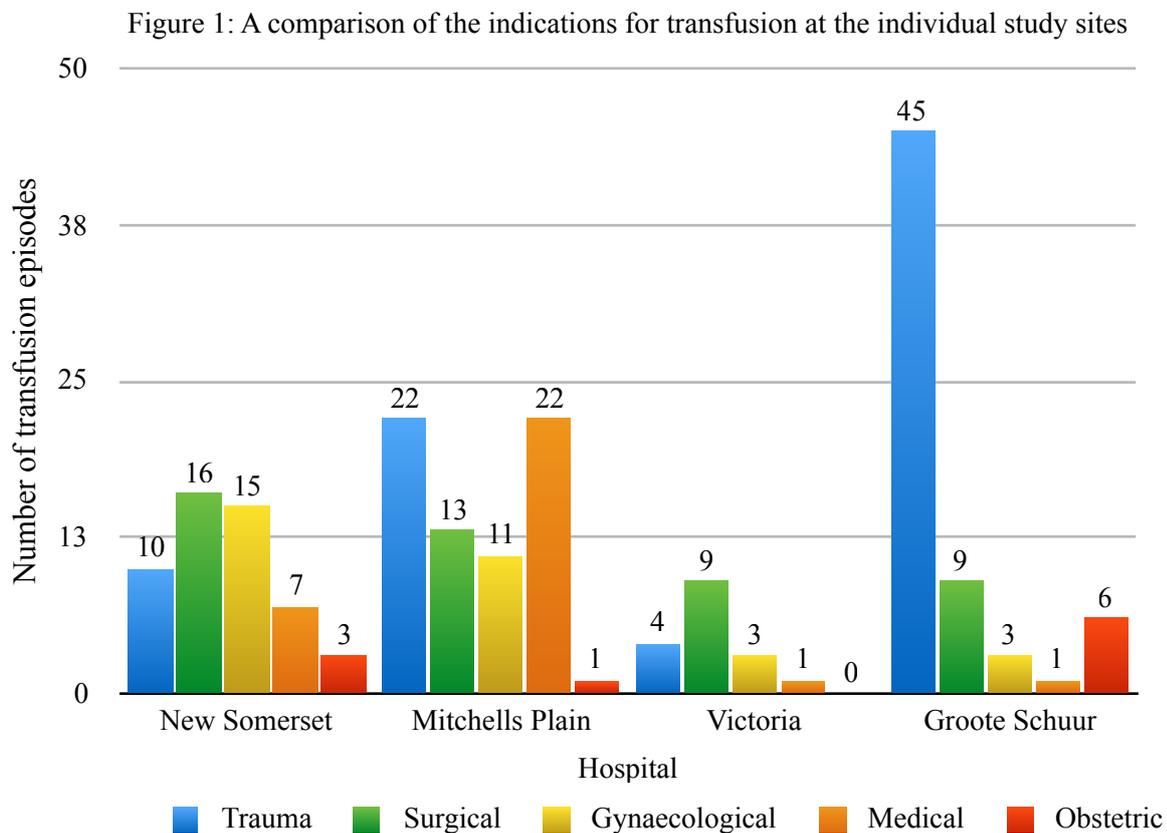


Figure 1 visually compares the major indication categories for transfusion between the individual study sites.

Discussion

In keeping with the existing literature, trauma was the major indication for the use of emergency blood both in the secondary level emergency centres and in the tertiary hospital. (13,14) Trauma also accounted for the largest volumes of blood used. Victims of trauma were likely to require a higher volume of emergency blood in their acute resuscitation (mean 1,9 units) than those receiving blood for other reasons (1,3 units). Trauma patients managed at the tertiary hospital tended to receive larger volumes of emergency blood (mean 2,1 units) than those at the secondary level emergency centres (mean 1,6 units) despite the presence of a blood bank on site to crossmatch blood. A number of factors may play a role in this observation. The prehospital triage of severely injured patients to the tertiary hospital is intended to match patient requirements to the available resources, including blood and blood products. The availability of larger volumes of emergency blood at the tertiary hospital and the familiarity of doctors working at a trauma centre with the use of large volumes of blood may lead to the administration of larger volumes of blood by the doctors at the tertiary hospital. The availability of advanced imaging to detect occult bleeding at the tertiary hospital may also predispose these patients to a larger volume of blood transfused. These factors remain speculation and further research is

needed to better define the factors leading to the use of larger volumes of emergency blood. Another possible consequence of the prehospital triage policy in practice is the higher proportion of polytrauma and gunshot wound victims seen requiring transfusion at the tertiary hospital compared to the secondary level hospitals, which saw a larger proportion of stab wounds. The burden of penetrating trauma; 61 of the 81 trauma cases (84%), reflects the prevalence of interpersonal violence, particularly gang-related violence, in the area.

The use of emergency blood for patients with anaemia is probably the most contentious finding of this study. While we did not attempt to define appropriate and inappropriate use, this is an indication that many would deem inappropriate for most of the wide variety of underlying conditions. Concerns about the use of emergency blood in this population include the expected need for repeat transfusions and the increased prevalence of alloimmunisation, raising the risk of transfusion reactions. (10,11,12) The major objection, however, is that the condition has often been present for a long period of time and should be managed in a planned fashion that limits the need for transfusion in general and emergency transfusion in particular. The tertiary hospital used no emergency blood for this indication, while there were 27 such episodes at the secondary level emergency centres, with one emergency centre in particular recording this indication frequently. It was beyond the scope of this study to record additional data such as the haemoglobin value and vital signs of these patients, but these data would help to ascertain whether emergency blood was indeed indicated or whether it would have been more appropriate to wait for crossmatched blood. The transport times, both real and perceived, of samples to and blood from the blood bank may also play a role, with the emergency centre using the most emergency blood for anaemia located furthest from the blood bank. Combined with the desire for prompt patient care and disposition from a busy emergency centre, a long blood transport time may influence doctors to utilise blood from the emergency blood fridge, although it remains difficult to justify. Further investigation is warranted into the use of emergency blood for patients with anaemia and perhaps the implementation of a guideline or gatekeeper strategy is necessary to limit the potentially avoidable transfusion of emergency blood.

Limitations of this study included the small sample size and short duration of the study period. While this limited the confidence of the infrequent indications, certain indications tended to occur commonly and at all study sites lending credibility despite the small sample.

The study was largely dependent on clinical staff to complete the study registers and record the indications for which emergency blood was transfused as these data are not routinely collected. While they were familiarised with the study and encouraged to confirm indications with the responsible doctor, this remained a potential source of misinformation. The small size of the study did not allow for dedicated research staff for the purpose of data collection. The variety of methods required to recover missing data would make the study difficult to replicate until such time as the study data sample becomes a part of routine data collection by the blood bank or the individual emergency centres.

The tertiary hospital included in this study does not offer a paediatric service, leading to significant underrepresentation of the paediatric population. There is a dedicated tertiary paediatric hospital within the study area to which the majority of paediatric trauma patients are transported directly. Children with less severe injuries and those presenting directly are treated at the secondary level emergency centres, which were included in the study. This limits the generalisability of the results with regards to the need for emergency blood in paediatric emergency care.

The strength of this study is that it traces the outlines of an area of practice that was hitherto uncharted. The results lay a foundation on which further research can build and to which similar studies can compare. The information can be used in drawing up local clinical guidelines for the use of emergency blood and in planning a massive transfusion protocol. The Western Province Blood Transfusion Service's knowledge of the clinician's use of their products may be expanded.

Conclusions

Trauma was the major indication for the transfusion of emergency blood in this study. Other frequent indications included upper gastrointestinal bleeding, ectopic pregnancy and anaemia. The volumes of emergency blood transfused per episode were highest in trauma patients, and higher at the tertiary hospital compared to the secondary level facilities. The majority of emergency transfusions were commenced in the emergency centres, with a small amount of the emergency blood stock being used in other areas of the hospitals, particularly theatre. Further research is needed to evaluate the clinical outcomes of the recipients of emergency blood as well as to describe the use of associated blood products in emergency transfusions. Appropriate use of this limited resource needs to be defined for each facility, and ongoing monitoring of the indications for which emergency blood is transfused at an individual hospital level is encouraged.

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