



# Uncrossmatched Blood Transfusion for Resuscitation Patients at the Emergency Department

Korakot Apiratwarakul<sup>1</sup>, Sivit Chanthawatthanarak<sup>1</sup>, Piyathida Klawkla<sup>2</sup>, Kamonwon lenghong<sup>1\*</sup>, Vajarabhongsa Bhudhisawasdi<sup>1</sup>, Takaaki Suzuki<sup>3</sup>

<sup>1</sup>Department of Emergency Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand; <sup>2</sup>Department of Emergency Medicine, Bangkok Hospital Phetchaburi, Phetchaburi, Thailand; <sup>3</sup>Department of Emergency and Critical Care Medicine, University of Tsukuba Hospital, Tsukuba, Japan

## Abstract

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**\*Correspondence:** Kamonwon lenghong, Department of Emergency Medicine, Khon Kaen University, Khon Kaen 40002, Thailand. E-mail: [Kamonwan@kku.ac.th](mailto:Kamonwan@kku.ac.th)  
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**BACKGROUND:** Patients with uncontrolled blood loss often require immediate blood transfusion after the bleeding is stopped. If it is an emergency situation, blood that has not been tested for compatibility (uncrossmatched red blood cell [URBC] products) can be used. However, no studies have been conducted to evaluate the effectiveness of this protocol.

**AIM:** The aim of the study is to evaluate the effectiveness of URBC transfusion in Srinagarind Hospital's emergency department (ED).

**METHODS:** This was a cross-sectional study that reviewed the medical records of ninety Thai patients over 18 years of age who received at least one unit of blood through URBC transfusion in the Srinagarind Hospital ED from September 2016 to August 2018.

**RESULTS:** The average age of the patients was 47.23 ± 18.2 years, and 73.3% were male. A total of 149 units of URBC were provided, with 54.44% of recipients being trauma patients and 27.78% being gastrointestinal bleeding patients. The 24-h and in-hospital mortality rates were 58.89 and 72.22%, respectively. There were no cases of acute blood transfusion complications or inappropriate URBC transfusion.

**CONCLUSIONS:** The transfusion of URBC necessary in patients with uncontrolled bleeding. No complications were found due to acute blood transfusion.

## Introduction

Thailand is ranked among the countries with the highest mortality rate from traffic accidents, representing 20 to 24.9 people/100,000 population [1]. The main causes of death in accident patients, especially within the first 48 h, are hemorrhage [2], [3] and coagulopathy at arrival to the hospital [4]. Treatment of blood loss consists of stopping the bleeding and performing a blood transfusion. If transfusion is performed at the earliest stages of injury, it can help reduce the risk of volume depletion, acidosis, diluted blood, and abnormal blood clotting [4], [5]. According to the advanced trauma life support guidelines (10<sup>th</sup> edition), if the patient still is experiencing a large amount of blood loss or is in shock after receiving at least one liter of fluids, they should receive type-specific blood. However, in an emergency situation in which there is no time to prepare type-specific blood, O Rh-negative blood that has not been tested for compatibility (uncrossmatched red blood cells [URBC]) may be used [6]. Srinagarind Hospital began implementing guidelines for uncrossmatched blood

transfusion using leukocyte-poor red cells (group O Rh-) in the emergency room in August 2016. According to these guidelines, URBC transfusion should be performed in accident patients with hemorrhagic shock of grade 3 or higher [7], cardiac arrest, or ABC (assessment of blood consumption) scores ≥2 [8]. This study was conducted to evaluate the effectiveness of this protocol at Srinagarind Hospital's emergency department (ED).

## Methods

This was a cross-sectional study. The sample consisted of ninety patients over 18 years of age who received at least one unit of URBC transfusion in the Srinagarind Hospital ED from September 2016 to August 2018. Ethics approval was provided by The Khon Kaen University Ethics Committee for Human Research (HE611508). The sample size was calculated based on the proportion of URBC transfusions reported

in a previous study by Harris *et al* [3]. In order to achieve a significance level of 5% and power of test of 0.8, we determined that a sample size of 90 would be required.

Data were retrieved from medical records and hospital databases. The primary outcomes were 24-h and in-hospital mortality rates of patients who received URBC transfusion. Secondary outcomes included length of hospital stay, the amount of fluids received in the ED, and total blood received in 24 h.

Statistical analysis was performed using SPSS for Windows version 16.0 (SPSS Inc., Chicago, IL, USA). Categorical data were presented as percentages, and continuous data were presented using mean and standard deviation. Univariable analysis was performed using a two-sample t-test for numerical data and a Pearson's correlation for data relationships between the two groups.

## Results

Ninety patients were examined, the characteristics of whom are shown in Table 1. The average age was  $47.23 \pm 18.2$  years, and 73.3% ( $n = 66$ ) were male. Trauma and non-trauma patients accounted for 54.44% and 45.56%, respectively, of the studied population. Patients with hemodynamic instability (first blood pressure measurement  $<90$  mmHg) accounted for 68.89%. The median of the Glasgow coma score was 6, and 80.0% of patients received endotracheal intubation. There were 51 cases of cardiac arrest, 35 of which occurred out-of-hospital. A total of 149 units of URBC was used, 22.22% for massive transfusion and 4.6 units for total blood transfusion within 24 h. The median volume

of fluid that patients received in the ED was 2,000 milliliters. The mortality rates in the first 24 h and in-hospital were 58.89% and 72.22%, respectively. The median duration in the ED was 120 min and hospitalization was 4.36 days. A total of 42.22% of patients underwent surgery or stopped bleeding in the operating room, and 23.33% experienced infection-related complications. There were no reports of acute intravascular hemolytic reaction.

A total of 53 patients, the majority of whom were male, died within 24 h (Table 2) mostly from trauma. A significantly higher number of patients in this group had severe signs, low systolic blood pressure ( $p < 0.001$ ), low heart rate ( $p = 0.014$ ), arterial blood pH lower than 7.2 ( $p = 0.005$ ), low Glasgow coma score ( $p < 0.001$ ), history of cardiac arrest, had used vasopressor drugs ( $p < 0.001$ ), underwent endotracheal tube intubation ( $p < 0.001$ ), and were administered a greater number of intravenous fluids at the ED ( $p < 0.001$ ).

The 24-h mortality rates of patients who received one, two, and three units of URBC were 54, 54.55, and 76.47%, respectively, and in-hospital mortality rates were 66, 72.73, and 88.24%, respectively (Table 3). Although the mortality rates were higher in patients who received two or three units than those who received only one, this difference was not statistically significant.

## Discussion

The transfusion of URBC is considered absolutely necessary in patients who lose large amounts of blood or experience uncontrolled shock. According to a previous study by Harris *et al.*, trauma patients are the most likely to receive URBC [3], [9]. We found that the rate of URBC transfusion in the non-trauma group was relatively high, with most being gastrointestinal bleeding patients. This may be due to Srinagarind Hospital having a smaller proportion of trauma patients compared to non-trauma patients. No acute intravascular hemolytic reaction occurred after URBC transfusion, which is consistent with the findings of a previous study [10], [11] and confirms the safety of URBC transfusion [12].

However, patients in our study who received URBC in the ED had a higher mortality rate than in previous studies. The 24-h and in-hospital mortality rates in all patients were 58.89% and 72.22%, respectively, compared to 26.6% in a study by Harris *et al.* [3]. Trauma patients had an even higher 24-h mortality rate, compared to only 28 to 47.55% in previous studies [13], [14]. This is likely because the patients in this study had more severe trauma, were more likely to have a history of endotracheal intubation and had very

**Table 1: Characteristics of patients receiving URBC transfusion**

Characteristics	Number (%)
Age, mean (range) years	47.23 (16-90)
Male	66 (73.3)
Trauma	49 (54.44)
Blunt	46 (45.56)
Penetrating	3 (3.33)
Nontrauma	41 (45.56)
Gastrointestinal bleeding	25 (27.78)
Ruptured hepatocellular carcinoma	7 (7.78)
Massive hemoptysis	3 (3.33)
Ruptured aneurysms	2 (2.22)
Obstetrics-related	2 (2.22)
Medical anemia	1 (1.11)
Hematuria	1 (1.11)
Hemodynamic instability	62 (68.89)
Glasgow coma score, median (range)	6 (3-15)
Endotracheal tube intubation	72 (80)
Cardiac arrest	
Out hospital	35 (68.62)
In hospital	16 (31.38)
URBC units in ED, mean $\pm$ SD	149 $\pm$ 1.66
Massive transfusion	20 (22.22)
Total URBC in 24 h, median (range) units	4.6 (1-33)
Volume of intravenous resuscitation at ED, median (range) ml	2000 (1000-3000)
Mortality within 24 h	53 (58.89)
Mortality, in-hospital	65 (72.22)
Time in ED, median (range) minutes	120 (90-180)
Length of stay, mean (range) days	4.36 (0-39)
Emergency surgery	38 (42.22)
Infection complication	21 (23.33)

URBC: Uncrossmatched red blood cell, ED: Emergency department.

**Table 2: Transfusion data by 24-h mortality**

Characteristics, number (%)	Survived 24 h	Died within 24 h	p-value
Number	37	53	
Age, mean $\pm$ SD years	44.11 $\pm$ 17.89	49.42 $\pm$ 18.25	0.175
Male	20 (54.05)	46 (86.79)	0.001
Etiology			
Trauma	15 (40.54)	34 (64.15)	0.027
Non trauma	22 (59.46)	19 (35.85)	
URBC units in ED, mean $\pm$ SD	1.49 $\pm$ 0.69	1.77 $\pm$ 0.89	0.104
Total URBC in 24 h, mean $\pm$ SD	5.11 $\pm$ 4.40	4.40 $\pm$ 5.67	0.513
Massive transfusion	8 (21.62)	12 (22.64)	0.909
Systolic blood pressure <90 mmHg	17 (45.95)	44 (83.02)	< 0.001
Heart rate, median (range)	102 (69–116)	0 (0–113)	0.014
Hematocrit (%), median (range)	27 (21–35)	30 (24–39)	0.240
Platelet <100,000	11 (29.73)	19 (35.85)	0.545
INR >1.5	12 (32.43)	19 (35.85)	0.737
pH <7.2	18 (48.65)	41 (77.36)	0.005
Glasgow coma score, median (range)	15 (6–15)	3 (3–9)	< 0.001
Cardiac arrest			
Out-of-hospital	5 (13.51)	30 (56.60)	<0.001
In-hospital	2 (5.41)	14 (26.42)	0.010
Vasopressor	18 (48.65)	48 (90.57)	<0.001
Tranexamic acid or Vitamin K	20 (54.05)	18 (33.96)	0.058
Endotracheal tube intubation	21 (56.76)	51 (96.23)	<0.001
Time in ED, median (range) min	130 (100–205)	120 (90–180)	0.245
Volume of intravenous fluids at ED (ml), median (range)	2000 (1000–2000)	3000 (2000–3000)	<0.001
Emergency surgery	29 (78.38)	9 (16.98)	<0.001

URBC: Uncrossmatched red blood cell, ED: Emergency department.

**Table 3: Patient's mortality rate**

No. of URBC	No. of patients	24-h mortality, %	Odd ratio (95% CI)	p-value	In hospital mortality, %	Odd ratio (95% CI)	p-value
1	50	54			66		
2	22	54.55	1.022 (0.37–2.79)	0.966	72.73	1.373 (0.45–4.15)	0.574
3	17	76.47	2.768 (0.79–9.67)	0.111	88.24	3.863 (0.79–18.89)	0.095
4	1	100					
Overall mortality		53 (58.89)			65 (72.22)		

URBC: Uncrossmatched red blood cell.

low Glasgow coma scores. We also found that both 24-h and in-hospital mortality rates increased with the amount of URBC transfused, which is consistent with the results of previous studies [2], [5]. However, this increase was not statistically significant, which may be the result of the small number of patients in each group or the fact that blood received per person is not small compared to those in a previous study [2]. We also found that the number of massive transfusions did not differ significantly between patients who survived and those who died within 24 h. The overall number of patients who underwent massive transfusion [9] was similar to that in the study by Harris *et al* [3] (about 25%).

This study was limited in that the data collected from medical charts may have been incomplete [15], [16], [17], [18], [19] and that the number of trauma patients included was quite small compared to other studies. Because URBC transfusion is performed at the discretion of the physician, some patients may not have received URBC or may have received blood that does not meet the criteria.

## Conclusion

The transfusion of URBC is often necessary for patients with uncontrolled bleeding. No complications due to acute blood transfusion were found.

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