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Blood transfusion in ICU: clinical practice and mortality factors

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ABSTRACT

Objective: *Evaluation of clinical practice, mortality and prognostic factors.* ***Materials and methods:*** *This is a retrospective survey conducted in a polyvalent ICU during five years. We collected 160 transfused patients during the study.* ***Results:*** *The average age in our study was 38±16.6 years with 67 % of males. Patients without medical history were 95% of cases. The average SOFA score was 6.34±2.5.The hemorrhagic shock was the main reason for blood transfusion in 72% of cases. Packed red cells were the most transfused in 77% of cases with an average of 2.3±0.7 units/patient. The mean hemoglobin level was 8.3±1.6 g/dl before vs 10.3±1.6 g/dl post transfusion. The mean number of fresh frozen plasma and platelet was 5.27±1.22 and 4.4±1.3 units / patient, respectively. The mortality rate was 37%. Hyperthermia (OR: 5; IC95%: 1,19-20,91; p:0.02), coagulopathy (elongated aPTT (activated partial thromboplastin time)) (OR: 1.24; IC95%: 1,04-1,48; p:0.01) and decrease in creatinine clearance (OR: 1.1; IC95%: 1,01-1,10; p:0.03) were independent factors of mortality.* ***Conclusion:*** *Our transfusional practice is rather restrictive except for trauma brain injury and patients with heart or coronary diseases or chronic obstructive pulmonary disease. Patients with hyperthermia or coagulopathy or renal failure have poor prognosis.*

Keywords : transfusion practice, blood transfusion, mortality, prognostic factors.

INTRODUCTION

Blood transfusion is frequently performed in resuscitation units; about one third of the patients who are hospitalized receive a transfusion during their stay (1). It is difficult to define transfusion criteria that apply to all ICU patients based on admission pathology and co-morbidities.

In any case, there is no magic number to retain as a transfusion threshold. On the contrary, the decision of packed red cells (PRC) transfusion should be individualized based on a series of clinical and biological criteria (2).

Our aim was to evaluate our transfusion practice, mortality and prognostic factors.

MATERIAL AND METHODS

This is a retrospective study conducted in the medical/surgical ICU (Ibn Tofail Hospital in

Marrakech). The study included 160 patients transfused over a period of five years.

Data were collected from hospital records and patient's medical records. They included epidemiological, clinical, biological, therapeutic and evolution variables. Severity was assessed using the SOFA (Sequential Organ Failure Assessment) and APACHE II (Acute Physiology and Chronic Health Evaluation) scores.

In our practice, the transfusion threshold of PRC is 7 g/dl, fresh frozen plasma (FFP) is 40% prothrombin and platelet is $50.10^3/mm^3$; except for the trauma brain injury patients, with cardiovascular disease or chronic obstructive pulmonary disease.

The data entry and analysis were done using SPSS for Windows version 10.0. Quantitative variables were expressed as mean±standard deviation. While the qualitative variables were expressed as a percentage. We subdivided our sample into two groups for the study of prognostic factors: "survivors" group and "deceased" group. For univariate statistical analysis, we used Student's t-test and chi-2. For multivariate analysis, we used multiple logistic regression. A $p < 0.05$ was considered significant.

RESULT AND DISCUSSION

The average age was 38±16.6 years with extremes of 1 to 76 years with a male predominance in 67% of cases. The other characteristics of our patients are summarized in Table 1.

Table 1: Baseline characteristics of patients at the admission.

	Values
History of transfusion	6%
Co-existing illness: heart Disease Coronary artery disease Chronic respiratory disease	 2% 2% 1%
Reasons for hospitalization: Surgical Medical	 67% 33%
Clinical features: Tachypnea / dyspnea Haemorrhagic shock SBP (mean ± SD), mmHg Glasgow coma scale (mean ± SD)	 25% 72% 118±25 11±3
Gravity scores: SOFA APACHE II	 6.34±2.5 19.5±7.8
Blood group : O A B AB Rh positive	 53% 31% 13% 3% 96%
Indications for transfusion: Haemorrhagic shock	 72%

Acute haemorrhage	23%
Clinical intolerance	5%

SBP: Systolic blood pressure; SOFA: Sequential Organ Failure Assessment ; APACHE II: Acute Physiology And Chronic Health Evaluation ; SD: standard deviation

PRCs are transfused alone in 77% of cases. The nature and quantity of transfused blood products are reported in Table 2.

Table 2: Nature and quantity of the transfused products.

	Values
Packed red cells transfusion : Percentage mean ± SD ≤ 2 PRC 3-4 PRC ≥ 5 PRC	 77% 2.3±0.7 units/patient 74% 25% 1%
Fresh frozen plasma (FFP) : Percentage mean±SD	 8% 5.27±1.22 units/patient
Platelets (PLT) : Percentage mean±SD	 1,3 % 4.4±1.3 units/patient
PRC + FFP	9,4%
PRC +PLT	1,3%
PRC + FFP+PLT	3%

PRC: Packed Red Cells; FFP: fresh frozen plasma; PLT: Platelets; SD: standard deviations

The mean hemoglobin level during our study was 8.3 ± 1.6 g / dl with a minimum value of 3.2 g/dl and a maximum of 16 g/dl. Other haematological parameters are listed in Table 3

Table 3: Hematological parameters in pre and post transfusion.

Parameters	**Pre-transfusion value**	**Post-transfusion value**
Hemoglobin (g/dl)	8.3 ± 1.6	10.3 ± 1.07
Hematocrit(%)	24.8 ± 5,9	29.5 ± 5.6
INR	1.49 ± 0.5	1.48 ± 0.2
APTT (sec)	32.1± 6.3	31.7 ± 5.4
Prothrombin rate (%)	68.6 ± 19.2	72.9 ± 16.4
Platelets(10^3/mm^3)	206.1 ± 115.5	205.2 ± 99.6

INR: International Normalized Ratio ; APTT: activated partial thromboplastin time; Sec: seconde

Only 4% of the patients presented side effects to blood transfusion: hyperthermia (four patients), haemolysis (one patient) and hemodynamic instability (one patient).

The mortality rate was 37%. In univariate analysis (Table 4), male sex, hyperthermia, initial patient severity, PRC transfusion, increased APTT, creatinine clearance, elevated bilirubin, and low prothrombin rate were considered prognostic factors.

Table 4: Univariate analysis mortality factors.

	Survivors (N = 101)	**Deceased (N = 59)**	**p**
Male sex	69%	31%	0,02
APACHE II	16 ± 4	26 ±8	< 0,001
Score SOFA	5 ± 2	8 ± 2	< 0,001
Température (°C)	37,5 ± 0,6	38 ± 1	0,01
Pre-transfusion APTT(sec)	31 ± 3	35 ± 10	0,01
Pre-transfusional creatinine(mg/l)	8 ± 3	15 ± 3	0,002
Pre-transfusion bilirubinemia(mg/)	13 ± 6	38 ± 20	< 0,001
PRC Transfusion	70%	30%	0,03
Post-transfusionnelle PR (%)	75 ±16	68 ±17	0,02

APACHE II: Acute Physiology And ChronicHealth Evaluation;SOFA: Sequential Organ FailureAssessment ;APTT: activated partial thromboplastin time; PRC: Globular cap; PR prothrombin rate

In multivariate analysis (Table 5), hyperthermia, coagulopathy and renal failure emerged as independent factors of poor prognosis in patients transfused in intensive care.

Table 5: Independent factors of mortality by logistic regression.

	OR	**p**	**95 %IC**
Hyperthermia	5	0,02	1,19 - 20,91
Incresed APTT	1,24	0,01	1,04 - 1,48
Decreased creatinine clearance	1,1	0,03	1,01 - 1,20

APTT: activated partial thromboplastin time

Discussion:

Blood transfusion can undoubtedly save lives in many medical and especially in surgical circumstances. The situation is particularly evident during severe haemorrhage accompanied by hypovolemia or when anemia is very severe. Observational studies such as those conducted in Kenya in severely anemic children (hemoglobin levels below 4 g/dl), have reported that early RBC transfusion can improve survival (3,4). In 1958 surgical patients refusing erythrocyte transfusions for religious belief, Carson et al (5) showed a clear association between the severity of preoperative anemia and the mortality at 30 days. Mortality increased from 1.3% for patients with hemoglobin ≥12 g/dl to 33.3% for patients with hemoglobin <6 g/dl. Anemic patients with severe peroperative hemorrhage had even higher mortality (4).

The blood transfusion thresholds have been lowered (6). Nowadays, the anemia is frequent and more severe. Thus, Walsh et al observed that 87% of men and 79.6% of women were anemic at the discharge of the ICU (7) and even at six months after in 50% of cases (8).

Current recommendations are rather restrictive; the transfusion threshold for a patient in the ICU is 7 g/dl, and possibly around 8-9 g / dl in the presence of certain diseases (9). These recommendations are based on the association found between blood transfusion and morbidity and mortality (10,11). A large randomized controlled trial that compares a restrictive strategy (transfusion threshold at 7 g / dl) to a liberal strategy (threshold at 9 g / dl), showed non-inferiority

of the first and even superiority in the youngest and less severe patients (8). This restriction remains a strong recommendation for non-severe anemic patients (12,13).

Some authors did not find association between transfusion and morbimortality, or even suggest a benefit in some patients (11). In consequence, the value of hemoglobin should not be the only element of the decision; this threshold value should be discussed according to the clinical context and tolerance. The mortality rate in our study was 37%. Transfusion was not a risk factor for mortality. Hyperthermia, coagulopathy and renal failure were considered as factors of poor prognosis. In 2012, Salah Al-Humood et al (14) showed that of the 475 patients admitted, 21% were transfused with a mortality rate of 24.2%. The latter was significantly associated with the APACHEII score, the SOFA score, the need for mechanical ventilation, the duration of mechanical ventilation and the length of stay in hospital. However, age, hemoglobin, length of stay in the ICU, and number of PRC units transfused were not associated with mortality. Furthermore, mechanically ventilated patients died more than others did. Mechanical ventilation increased the mortality risk by 1.4%, and there was no significant association between mortality and hemoglobin levels prior to transfusion. Other studies showed conflicting results regarding the relationship between blood transfusion and mortality. It was widely argued that blood transfusion could be associated with improved survival. Possible explanations for these differences include the use of leukocyte reduction in PRC and the adoption of a restrictive transfusion strategy (15). In 2018, Michael et al showed an increase in duration of mechanical ventilation in patients RBC transfused compared with those who were not after controlling for known risk markers for poor outcomes. There was no association of any blood product with mortality (16). Another retrospective observational study of 385 patients, showed that the plasma to packed red blood cells ratios ≥ 1 were identified as an independent factor for decreased in-hospital mortality (adjusted OR 0.43 [95%CI 0.22-0.81])of patients with isolated severe blunt traumatic brain injury (17). In a randomized study (936 patients with gastrointestinal bleeding), Jairath et al declared that the mortality was 3% with liberal transfusion versus 12% with restrictive transfusion without significant difference (18).

CONCLUSION

Our transfusional practice is rather restrictive except for trauma brain injury and patients with heart or coronary diseases or chronic obstructive pulmonary disease. Patients with hyperthermia or coagulopathy or renal failure have poor prognosis.

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