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Anemia in Critically Ill Patients; Prevalence and Prognostic Implications

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Abstract

Background: Anemia is a commonly encountered clinical problem in the critically ill. Ninety-five percent of critically ill patients who stay in the Intensive Care Unit (ICU) for 72 hours or greater suffer from anemia and approximately 40% of them receive Packed Red Blood Cell (PRBC) transfusions. In 2001, nearly 14 million units of packed red blood cells were transfused, but the physiologic basis for transfusion in the critically ill is not without controversy. In the last two decades transfusion practices have become more restrictive likely in response to prospective research.

Aim of Study: The aim of this work is to evaluate the prevalence of anemia in critically ill patients and to assess the effect of anemia of critical illness on the patients' outcome.

Patients and Methods: The study was conducted from the existing data base in the Critical Care Department of Elsahel Teaching Hospital from January 2015 to December 2018. The collected data focused on fulfilling the following measures on the selected patients: Comparison of age, length of ICU stays of the patients and APACHE II score in survivors and non survivors groups, frequency of blood transfusion and iron supplementation in the management of anemia of critical illness and its association with the outcome, the relation of follow-up complete blood count and the outcome.

Results: In this retrospective cohort study involving 165 patients 74 males and 91 females with mean age 55. 13±20.72, and mean length of stay 11, 87±12,04. The survivors were 103 (62.5%), and those who not survive were 62 (37.5%) the mean hemoglobin at admission was 8.28g dl^{-1} (±1.96) for survivors group and 8.27 (±2.36) for non survivors. reasons of admission which were associated with higher frequency of mortality among the others are post cardiac arrest, respiratory failure, neurologic problems, cardiogenic shock, septic shock, acute renal failure and obstetrics catastrophes with frequency (85.7%, 77.8%, 66.7%, 60%, 55%, 45.5%, 60%) respectively. Regarding blood transfusion as in management of anemia, in this study there were no significant difference in relation of blood transfusion and the outcome (our hemoglobin threshold was 7g/dl). In this study we had 78 patients admitted for more than fourteen days in the ICU they represent 25% of our study group 39.7% of them died with hemoglobind 7g/dl which was chosen as a best predictor to outcome.

Conclusion: It was found that there is no association between management of anemia (blood transfusion and iron supplementation) and the outcome of the patient and that patient's hemoglobin at the end of ICU stay is of good prognostic value of anemic patients.

Key Words: *Anemia in critically Ill patients – Prevalence and prognostic implications.*

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Introduction

ANEMIA of critical illness is defined as anemia in the critically ill patient that cannot be explained by other causes and that is characterized by an inadequate response of endogenous erythropoietin in relation to the degree of hemoglobin deficiency present **[1]**. The prevalence of anemia in the Intensive Care Unit (ICU) warrants a detailed evaluation and review of the available therapeutic options **[2,3]**.

During an average ICU stay, a critically ill patient can lose a total of 762ml of blood to laboratory tests **[1]**. A recent report from ICUs in Western Europe demonstrated an average total phlebotomy volume of 41.1ml during a 24-hour observation period. Another study in trauma patients suggested that laboratory testing is becoming more frequent with an increase in the number of blood tests ordered **[4]**.

Critically ill patients are exposed to blood loss that will inevitably participate in the onset or worsening of anemia **[5]**, but also potentially to a true iron deficiency **[6]**. A recent study in Australia and New Zealand reported that bleeding was the reason for transfusion in 46% of transfusion events **[7]**. Blood loss is rarely the only explanation for anemia. During resuscitation with colloid and crystalloid solutions hemodilution contributes to

the rapid decrease in hemoglobin concentration seen early after ICU admission in many critically ill patients without altering red cell mass **[8]**.

A major factor resulting in the development and persistence of anemia is reduced new red blood cell production (erythropoiesis) which occurs in the bone marrow and is controlled by erythropoietin hormone **[9]**. This appears to result from a combination of inappropriately low circulating erythropoietin and hypo-reactive bone marrow. Inflammation is responsible for a transcriptional repression of erythropoietin synthesis, mediated by many proinflammatory cytokines (including TNF-α and IL1). In addition, erythropoietin receptor expression is suppressed by inflammatory cytokines **[10]**.

Hemolysis may also cause anemia in critically ill patients. This may be associated with several pathologic conditions, including bacterial infections, malaria, trauma and conditions in which mechanical forces can lead to RBCs rupture, such as surgical procedures, hemodialysis and blood transfusion. Hemolysis results in release of free plasma hemoglobin and heme, which are toxic to the vascular endothelium **[11]**. Hypersplenism may also lead to excessive RBCs destruction. As hemolytic anemia occurs because of intrasplenic destruction of erythrocytes **[12]**.

The pathophysiologic consequences of anemia in critically ill patients include inadequate tissue oxygenation and eventual ischemia of end organs. Inadequate tissue oxygenation results from either decreased oxygen delivery and/or increased tissue oxygen consumption. Oxygen delivery is a function of arterial oxygen content and cardiac output. Hemoglobin concentration and Oxygen saturation both affect arterial oxygen content **[13]**. Oxygen consumption is the rate at which tissues take up oxygen and is a function of oxygen delivery and the amount of oxygen that is extracted by tissues (i.e., the oxygen extraction ratio).

The 'critical hemoglobin concentration' is usually defined as the concentration below which oxygen consumption is supply-dependent assuming normovolaemia is maintained **[14,15]**. This is unlikely to be a fixed value, but varies between organs and is dependent on the metabolic activity of the tissue and oxygen extraction capabilities.

Despite these factors anemia is well tolerated by critically ill patients and a hemoglobin of 7-9 g/dl does not adversely affect outcome in comparison with maintaining a value >10g dl^{-1}. The effectiveness of red blood cell transfusions in patients with hemoglobin concentration >7-8g dl^{-1} has not been proved either for outcome or for improving tissue hypoxia **[16]**.

Aim of the study:

The aim of this work is to evaluate the prevalence of anemia in critically ill patients and to assess the effect of anemia of critical illness on the patients' outcome.

Patients and Methods

This retrospective historical cohort study was conducted from the existing data base in the Critical Care Department of Elsahel Teaching Hospital from January 2015 to December 2018 and was conducted on one hundred and sixty five-critical care patients.

Sample size was calculated using PASS program, setting alpha error at 5% and confidence interval width at 0.15. Result from previous study (Vincent et al., 2002) showed that 60% of patients admitted to ICU get anemia **[17]**.

Inclusion criteria:

The study was conducted on the patients admitted to the Critical Care Department with anemia or developed anemia during their ICU course.

Exclusion criteria:

1- Hemorrhagic anemia due to surgical causes.

2- Congenital causes of anemia as sickle cell thalassaemia.

3- Hemolytic anemia as a direct cause of ICU admission.

Data collection focused on fulfilling the following measures on the selected patients:

- Comparison of age, length of ICU stays of the patients and APACHE II score in survivors and non survivors groups.
- Frequency of the reasons of admission and its association with the outcome.
- Frequency of patients with anemia of critical illness mechanically ventilated and had vasoactive drugs.
- Frequency of blood transfusion and iron supplementation in the management of anemia of critical illness and its association with the outcome.
- The relation of follow-up complete blood count and the outcome.

Clinical end point:

All clinical events were reviewed and documented. The clinical end point was the documented

end of ICU stay either by death of the patient or improvement discharge or DAMA (discharge against medical advises) document.

Statistical methods:

- Data were verified and coded prior to analysis.
- All quantitative data were expressed as mean ± SD.
- All qualitative data were expressed as frequency tables.
- Chi-square test to confirm the presence of association between different categorical data. Student *t*-test to compare between quantitative data.
- *p*-value <0.05 considered significant.
- Analysis has been performed using SPSS (statistical package for social science).

Results

Table (1): Demographic disruptions among the study.

Variable	Mean (± std. deviation)
Age	55.13 (±20.72)
Length of ICU stay in days	11.87 (±12.049)
	Number (%)
Males	74 (44.5%)
Females	91 (55.5%)
Survivors	103 (62.5%)
Non survivors	62 (37.5%)
Total	165 (100%)

The survivors were 103 (62.5%), and non survivors were 62 (37.5%).

Table (2): Comparison of age, length of ICU stays of the patients and APACHE II score in survivors and non survivors groups.

	Survivors		Non survivors		*t*	*p*-value
	Number	Mean (std.deviation)	Number	Mean (std.deviation)		
Age	103	55.6809 (±19.79478)	62	54.2301 (±22.24218)	0.571	0.569
Length of ICU stay in days	103	11.7500 (±11.09301)	62	12.0708 (±13.54142)	0.223	0.832
APACHEII	103	15.617 (±5.80910)	62	20.8850 (±7.64707)	6.310-	0.0001

An independent *t*-test was conducted to compare age, length of ICU stay, APACHE II score, and blood transfusions in survivors and non survivors groups. A significant higher value of APACHE was found in non survivors (20.88±7.647 versus 12.61±5.809, *p*=.0001).

Table (3): The association of reasons of admission and out comes.

	Survivors		Non survivors		Total n (%) within total	χ^2	*p*-value
	N (% in reason)	Outcome %	N (% in reason)	Outcome %			
Post cardiac arrest	1 (14.3%)	.5%	2 (85.7%)	5.3%	3 (2.3%)	52.073	.0001
Acute coronary syndrome	31 (80.6%)	30.9%	8 (19.4%)	12.4%	39 (23.9%)		
Acute heart failure	14 (81.3%)	8.6%	4 (18.8%)	2%	18 (10.6%)		
Arrhythmias	8 (83.3%)	8%	2 (16.7%)	2.7%	10 (6%)		
Other cardio-vascular	5 (66.7%)	4.3%	2 (33.3%)	3.5%	7 (4%)		
Respiratory failure	3 (22.2%)	2.1%	7 (77.8%)	12.4%	10 (6%)		
Other respiratory	2 (50%)	1.6%	2 (50%)	2.7%	4 (2%)		
Neurologic problems	4 (33.3%)	3.2%	6 (66.7%)	10.6%	10 (6%)		
Hypovolumic shock	17 (66%)	16.5%	9 (34%)	14.2%	26 (15.6%)		
Cardiogenic shock	2 (40%)	2.1%	4 (60%)	5.3%	6 (3.3%)		
Septic shock	5 (45%)	4.8%	6 (55%)	9.7%	11 (6.6%)		
Acute renal failure	4 (54.5%)	3.2%	2 (45.5%)	4.4%	6 (3.7%)		
Obstetric catastrophes	1 (40%)	2.1%	3 (60%)	5.3%	4 (3.3%)		
Others	6 (65%)	6.9%	5 (35%)	6.2%	11 (6.6%)		
Total	103 (62.5%)	100%	62 (37.5%)	100%	165 (100%)		

A chi-square test of independence was calculated comparing the frequency of reasons of admissions named before and the outcomes. Post cardiac arrest, respiratory failure, neurologic problems, cardiogenic shock, septic shock, acute renal failure and obstetrics catastrophes were associated with higher frequency of mortality among the total number of each reason; (85.7%, 77.8%, 66.7%, 60%, 55%, 45.5%, 60%) respectively. A significant inter action was found χ^2 **[13]**=52.073 *p*<.05.

Table (4): Frequency of patients mechanically ventilated and had vasoactive drugs.

Variables	Number (%)
MV	77 (46.8%)
No vasoactive drugs	79 (47.9%)
Both vasoactive drugs	42 (25.4)
Inotropic drugs only	7 (4.3%)
Vasopressor drugs only	37 (22.4%)
Total	165 (100%)

Out of 165 cases 77 (46.8%) cases were mechanically ventilated, 86 (52.5%) cases had taken vasoactive drugs, patients had inotropic drugs only where 7 (4.3%), 37 (22.4%) cases had taken vasopressors drugs only as hemodynamic support, while 42 (25.4%) where on both inotropics and vasopressors.

A non significant interaction was found comparing the frequency of blood transfusions, and iron supplementation in management of anemia in critical illness and the outcome using chi-square test of independence. (χ^2 **[6]**=10.044, p=.123, χ^2 **[1]**=.563, p=.453) respectively.

An independent-sample *t*-test was conducted to compare complete blood count and follow-up of hemoglobin and HCT in survivors and non survivors. A significant difference were in hemoglobin in 14th day, hemoglobin at the end of ICU stay, WBCs at admission, platelets at admission p<.05.

Table (5): The association between management of anemia of critical illness and the outcome.

	Survivors	Non survivors	Total n (%) within total patients	Chi square/fisher exact	
				χ^2	*p*-value
No blood transfusion	40 (24.2%)	23 (14%)	63 (38.2%)	10.044	.123
Blood transfusion	63 (38.3%)	39 (23.5%)	102 (61.8%)		
Total	103 (62.5%)	62 (37.5%)	165 (100%)		
No iron supplementations	70 (42.5%)	45 (26.6%)	114 (69.1%)	.563	.453
Iron supplementation	33 (20%)	18 (10.9%)	51 (30.9%)		
Total	103 (62.5%)	62 (37.5%)	165 (100%)		

Table (6): The relation of follow-up complete blood count and the outcome.

	Number	Mean (std. deviation)	Number	Mean (std. deviation)	*t*	*p*-value
Hemoglobin at admission	103	8.28 (±1.967)	62	8.27 (±2.368)	.039	.969
Hemoglobin in 3rd day	93	8.98 (±4.51)	49	9.09 (±7.82)	.140-	.889
Hemoglobin in 7th day	61	9.4 (±7.710)	33	9.40 (±8.741)	.040	.968
Hemoglobin in14th day	22	8.56 (±1.223)	16	7.706 (±.915)	3.445	.001
Hemoglobin at discharge	94	9.26 (±1.075)	56	8.11 (±1.820)	6.112	.0001
WBCs at admission	99	11.53 (±6.294)	66	14.34 (±11.025)	2.476-	.014
Platelets counts at admission	95	230.04 (±133.72)	70	182.44 (±125.45)	3.060	.002

Discussion

Anemia is highly prevalent in critically ill and injured patients. Approximately two-thirds present with a hemoglobin concentration less than 12g/dl on admission, and 97% become anemic by Day 8 **[17,18]**. Optimal management of the anemia of critical illness is an area of much controversy and ongoing research.

The prevalence of anemia among critically ill patients is influenced by factors that include patient case mix, illness severity and pre-existing comorbidity.

Several recent studies have documented the prevalence of anemia on admission to ICU. A cohort study of 3534 patients admitted to 146 Western European ICUs with varying case mix (the ABC study; anemia and blood transfusion in critical care trial) found that the mean hemoglobin concentration at ICU admission was 11.3g dl^{-1} **[17]**.

A similarly designed study in the USA examined 4892 admissions to ICUs (the CRIT study; Anemia and blood transfusion in the critically ill-current clinical practice in the United States) **[3]**. In this study the mean hemoglobin concentration at ICU admission was 11.0g dl^{-1}.

A cohort study of 1023 sequential admissions to 10 Scottish ICUs found that the median hemo-

globin concentration at ICU admission was 10.5g dl^{-1} (inter quartile range 9.0-12.4g dl^{-1}) **[19]**. The authors also showed that the patients studied represented 44% of all general adult ICU admissions nationally over the study period. At ICU admission, 25% of patients had a hemoglobin concentration <9g dl^{-1} (range 16-34% across the 10 ICUs).

Among ICU survivors and non-survivors 21 and 29%, respectively, of patients had an admission hemoglobin concentration <9g dl^{-1} at ICU admission.

The prevalence of anemia at ICU admission varies, but it appears that 20-30% of patients have moderate to severe anemia (hemoglobin concentration <9g dl^{-1}). Only 10-15% had documented pre-existing anemia.

In this retrospective cohort study involving 165 patients 74 males and 91 females with mean age 55.13±20.72, and mean length of stay 11,87±12,04.

The survivors were 103 (62.5%), and those who not survive were 62 (37.5%) the mean hemoglobin at admission was 8.28g dl^{-1} (±1.96) for survivors group and 8.27 (±2.36) for non survivors, which is lower than the mean hemoglobin in the ABC study which was (11.3g/dl) **[49]**, and in the CRIT study (11.0g/dl) **[3]**, but correlate with the 25% of the patients among the multicenter Scottish study who had hemoglobin concentrations <9g/dl.

The prevalence and severity of anemia during ICU admission is clearly linked closely with the transfusion practice used. The evolution of anemia among non-transfused, non-bleeding, critically ill patients is difficult to study both ethically and in practice.

Fifty-two per cent of patients in the TRICC study (Transfusion Requirements in Critical Care trial) had a hemoglobin concentration ≤9g dl–1 on the first day of ICU care, increasing to 77% by second day **[20]**, this result support our study in which the mean hemoglobin concentration in the 3rd day after admission were 8.98 (±4.51) for survivors group and 9.09 (±7.82) for non survivors group which was a little higher than the mean in the first day of admission.

However, Nguyen and colleagues found that among non-bleeding ICU patients who did not receive red cell transfusions hemoglobin concentrations decreased by a mean 0.52g dl^{-1} day^{-1} **[21]**.

On average, hemoglobin concentrations decreased by 0.66g dl^{-1} day^{-1} for the first 3 days and by 0.12g dl^{-1} day^{-1} thereafter. This early rapid decrease in hemoglobin values was also found in a prospective observational single center cohort study of patients receiving >24h of intensive care **[20]**.

Also, in the CRIT study in USA ICUs, the mean hemoglobin concentration in a cohort of non-transfused patients decreased from ~12g dl^{-1} at admission to 11g dl^{-1} by days 3-4, after which values reached a plateau among patients remaining in the study **[3]**.

Patients among this study how were admitted because of cardiac diseases represented 50.1%of the total patients among the study and the non survivors group of them represent 31.2% of the total mortality outcome while those who were admitted due to respiratory causes represent 8% of the total and 15.1% of the total mortality outcome, 6% of the total admitted due to neurogenic problems, 15.6% of total had hypovolemic shock, 6.6% had septic shock, and 6.6% had obstetric catastrophes.

In this study, reasons of admission which were associated with higher frequency of mortality among the others are post cardiac arrest, respiratory failure, neurologic problems, cardiogenic shock, septic shock, acute renal failure and obstetrics catastrophes with frequency (85.7%, 77.8%, 66.7%, 60%, 55%, 45.5%, 60%) respectively.

Numerous recent studies have shown anemia to be associated with worse outcomes in patients with coronary artery disease. After reviewing the data on nearly 40,000 patients enrolled in trials on Acute Coronary Syndrome (ACS) Sabatine et al., found anemia to be associated with a greater likelihood of death in patients with ST-Segment Elevation MI (STEMI) and Non-ST-Segment Elevation MI (NSTEMI) **[22]**. These investigators also found an increased association of anemia with recurrent ischemia or acute MI in patients with NSTEMI. Aronson et al., found that lower nadir hemoglobin in hospitalized patients following MI were strongly associated with increased mortality **[23]** and those results correlate with this study.

According to respiratory failure and mechanically ventilated patients, Nevins and Epstein found anemia (mean hematocrit 36) to be associated with poor outcomes in a retrospective study of 166 patients with Chronic Obstructive Pulmonary Disease (COPD) receiving mechanical ventilation (type 2 respiratory failure) **[24]**. Although, data exists showing anemia to be associated with poorer outcomes in mechanically ventilated patients, no significant literature supports the transfusion of

Packed Red Blood Cells (PRBC) to facilitate weaning patients from mechanical ventilation **[25]**.

Khamiees et al., in a prospective observational study found anemia (Hgb <10g/dL) to be associated with extubation failure in a mixed medical-surgical ICU population **[26]**.

Analyses of the medical arm of the National Emphysema Treatment Trial **[27]** and of patients in the French ANTADIR database with severe O_2-requiring COPD **[28]** identified anemia as an independent predictor of death.

Anemia is associated with worse outcomes in nontraumatic subarachnoid hemorrhage (ruptured brain aneurysm) **[29]**. Preventing brain hypoxia might be important to reduce the incidence and severity of cerebral infarction from vasospasm, and P-RBC transfusion in that setting leads to improved markers of brain tissue function on positron emission tomography **[30]**.

The BOOST2 study is planned to assess if brain oxygen tension-guided therapy improves outcomes; Intracerebral hemorrhage does not lead to vasospasm, but cerebral infarction can be found on magnetic resonance imaging scans **[31]** and this may impact outcomes. There is probably not hypoxia around the clot **[32]**, but there may be altered metabolism for a period of several days **[33]**.

Anemia is also a common occurrence in the setting of sepsis **[34]**. This is in part because mediators of sepsis (e.g., TNF-α and IL-1β) decrease expression of the erythropoietin gene and protein **[35]**. Goal-directed therapy during early severe sepsis discuss the higher mortality rate of anemic patients with sever sepsis and the improvement of mortality in a well-performed single center randomized trial **[36]**. The intervention algorithm used central venous oxygen saturation <70% as a trigger for interventions to increase global oxygen delivery. Part of this algorithm was blood transfusion to maintain a haematocrit ≥30% (haemoglobin ≥10 g dl^{-1}), but it is unclear how important this component was to improving mortality **[37]**.

In the TRICC trial, subgroup analyses of older or more severely ill patients showed no difference in 30-day mortality between the restrictive-strategy and liberal strategy groups. Younger and less ill patients had better outcomes if transfused in a more restrictive manner (i.e., at lower hemoglobin) **[34]**.

Regarding blood transfusion as in management of anemia, in this study there were no significant difference in relation of blood transfusion and the outcome (our hemoglobin threshold was 7g/dl).

In the study there were 63 patients out of 165 had no blood transfusion, 23 patients of them not survive represent 14% of the total, while there were 102 patients had blood transfusion during their ICU sitting, 40 patients of them not survive represent 23.6% of the total patients. This result had an agreement with the appropriate RBC transfusion thresholds. In the Transfusion Requirements in Critical Care (TRICC) where **[34]**, 838 euvolemic patients without chronic anemia, myocardial ischemia, or on-going bleeding were randomized to either a restrictive or liberal transfusion strategy (threshold hemoglobin, 7 vs. 10g/dl). No difference in the primary outcome of all-cause 30-day mortality was observed between treatment arms. Subgroup analyses identified patients less than 55 years old and with APACHE II scores less than 20 as having decreased 30-day mortality with a restrictive strategy. Although results of this trial have affected both guidelines and common practice, controversy still exists regarding specific patient groups: The elderly, and those with cardiovascular disease, with difficulty being liberated from mechanical ventilation, and in the early phase of septic shock.

Several groups have examined the association of transfusions and mortality in large data sets of patients with acute coronary syndromes. Of these, one found transfusions to have a beneficial effect on survival when the hematocrit was less than 33% **[38]**. In contrast, four studies found transfusions to be an independent predictor of greater short-term mortality **[39,40]**; one identified a threshold hematocrit of 25%, above which transfusions were associated with increased risk of death **[41]**. It is difficult to exclude confounding in such studies, and further trials of transfusion thresholds among patients with ischemic heart disease are needed.

Regarding effect of blood transfusion as a management of anemia on the ventilated patients in our study there was no significant in mortality between ventilated patients who received blood transfusion and those who did not received, although ventilation affect the outcome and had a high mortality blood transfusion did not improve the outcome.

This result had a disagreement with Schönhofer and colleagues found that transfusion to goal hemoglobin greater than 11g/dl decreased ventilation and work of breathing **[42]**.

In a study of five anemic patients with COPD (mean hemoglobin, 8.7g/dl) who were unable to be liberated from mechanical ventilation (28-d mean duration of ventilation; range, 13 to 49d) **[43]**, all were successfully extubated within 4 days of being transfused to a mean hemoglobin level of 12.4g/dl.

Also, the TRICC trial included 713 patients on mechanical ventilation, of whom 219 were ventilated for greater than 7 days. In these subgroups, there was no difference in duration of mechanical ventilation or mortality between the two transfusion strategies **[44]**. This analysis had power only to detect 25% differences in duration of mechanical ventilation, so a clinically important difference may have been missed. Transfusion is most likely to be beneficial in patients with the most severe ventilatory impairment and respiratory muscle weakness, and it remains to be determined whether and when a more liberal transfusion strategy is warranted in these patients.

In this study, there were 51 patients had iron supplementation; 17 of them not survived represent 28.3% within the outcome and 10.6% within the total, with p=.453, this result agree with few studies have examined iron supplementation in the critical care population.

One retrospective analysis in surgery patients identified 27 who received intravenous iron therapy, and found that compared with matched control subjects; these patients did not have higher rates of bacteremia **[45]**.

However intravenous iron supplementation may have better efficacy than enteral administration because of the block of intestinal absorption by hepcidin. It has been shown that iron may be useful in heart failure and pulmonary hypertension **[46,47]**.

In this study we had 78 patients admitted for more than fourteen days in the ICU they represent 25% of our study group 39.7% of them died with hemoglobind 7g/dl which was chosen as a best predictor to outcome.

This agreed with a large epidemiologic study, conducted in European ICUs, reported that lower hemoglobin levels are associated with longer ICU length of stay and increased in-hospital mortality **[17]**.

Conclusion:

A growing body of literature on anemia of critical illness points to four conclusions:

1- Anemia is highly prevalent in the critically ill.

2- It is associated with higher health care resource use.

3- It may be associated with poor patient outcomes; and

4- There is no currently available therapy without shortcomings.

According to data collected we recommended the following;

a- As much as possible decrease unnecessary blood sample tests; the introduction of blood conservation sampling devices should be considered to reduce phlebotomy-associated blood loss as much as possible decrease unnecessary blood sample tests.

b- Activate non invasive hemodynamic monitoring.

c- As much as possible shorten the duration spent in ICUs.

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دراسة شيوع آنيميا الحالات الحرجة ومدى تآثيرها

يتم تعريف آنيميا الحالات الحرجة بآنها فقر الدم لدى المريض فى حالة صحية حرجة ولا يمكن تفسير آسباب آخرى لوجود الآنيميا والتى تتميز بإستجابة غير كافية للإريثروبويتين لتعويض درجة نقص الهيموجلوبين الحاضر. وإنتشار فقر الدم فى وحدة العناية المركزة (ICU) تستدعى تقييم مفصل وإستعراض الخيارات العلاجية المتاحة.

والآثار الفسيولوباثولوجية لآنيميا الحالات الحرجة على المرضى المصابين بآمراض خطيرة تشمل نقص الآوكسجين فى الآنسجة وقصور فى وظائف آجهزة الجسم الحيوية ما يؤدى فى النهاية إلى فشل تلك الآجهزة فى تآدية وظائفها وتدمير آنسجتها.

وفقاً للبيانات التى تم جمعها من قاعدة البيانات الموجودة فى قسم العناية المركزة بمستشفى الساحل التعليمى خلال الفترة من يناير ٢٠١٥ وحتى ديسمبر ٢٠١٨ لآسباب طبية مختلفة، وبعد إستبعاد معايير الإستبعاد المحددة سلفاً فى بروتوكول إجراء الدراسة على ١٦٥ مريضاً.

ومن هذه الدراسة والدراسات السابقة والمنشورة خلصنا إلى الإستنتاجات الآتية:

(١) فقر الدم منتشر بشكل كبير فى مرضى الحالات الحرجة.

(٢) ويرتبط هذا مع إستخدام الموارد الرعاية الصحية آعلى.

(٣) قد تترافق مع نتائج سيئة المريض.

(٤) لا توجد طرق للعلاج المتوفرة حالياً دون عيوب.

هناك حاجة إلى مزيد من الآبحاث لتحديد المخاطر والمنافع، وفعالية إستراتيجيات العلاج مع الآخذ فى الإعتبار إختلاف بيئة المريض. وإلى آن تظهر آبحاث جديدة ونتائج فعالة لعلاج آنيميا الحالات الحرجة ينبغى على آطباء الرعاية الحرجة آن يولى إهتماماً حريضاً على تقليل فقدان الدم كلما كان ذلك ممكناً، ووضع خطه علاج الآنيميا ضمن الخطة الرئيسية للعلاج حسب حالة كل مريض.