

Evaluation of Blood Sampling from Patients Admitted to Intensive Care Unit (ICU)

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ABSTRACT

Venous blood sampling is widely used in the intensive care unit and in this regard, hemoglobin and hematocrit are among the important parameters related to anemia in critically ill patients. Therefore, due to the importance of hemoglobin and hematocrit in the intensive care unit, the present study was conducted to investigate blood and biochemical parameters in the intensive care unit of Imam Ali (AS) Hospital in Zahedan in 2020.

Methods: The present study is a cross-sectional analytical study that was performed on 104 patients admitted to the intensive care unit of Imam Ali Hospital in 2020. Demographic and clinical information of patients and information related to the amount of hemoglobin and hematocrit of blood, etc. were collected in the relevant checklist. After entering the information of the samples through SPSS software version 20, with descriptive statistical methods, the amount of hemoglobin and Hematocrit was statistically analyzed in intensive care units.

Results: In this study, the mean and standard deviation of hemoglobin on the first and last day were 11.9 ± 2.9 and 2.08 ± 9.9 , respectively, and the mean and standard deviation of hematocrit on the first and last day were 37.3 ± 8.6 and 31.4 ± 6 , respectively. The patients studied in this study were diagnosed with burns, lung diseases, poisoning and gynecological diseases and other diseases and a statistically significant and negative difference was observed between hemoglobin and hematocrit on the last day and blood volume taken from patients (p -value ≤ 0.001).

INTRODUCTION

Anemia is a decrease in the oxygen-carrying capacity of the blood. Blood oxygen transport capacity is one of the functions of red blood cells in circulating blood volume. Therefore, it can be said that anemia is a decrease in the volume of red blood cells. This variable can be measured using chromium-labeled erythrocytes, but no specific methodology is available for clinical use. Therefore, therapists use an alternative definition of anemia based on the concentration of hemoglobin and hematocrit. (1).

Anemia is one of the most common disorders in the intensive care unit. Evidence shows that half of patients admitted to the intensive care unit are hospitalized with anemia and 60% of patients have anemia at a period of time while in hospital and half of patients discharged from this ward are discharged with anemia (1).

However, there is no consensus on its intensity and importance in all research. While some articles emphasize that moderate to severe anemia (hemoglobin equal to or less than 10) is independently associated with 90-day mortality even in rescued or discharged patients (2-6).

Others believe that chronic patients in the intensive care unit tolerate low levels of hemoglobin (between 7-10) and that blood transfusions have more harms than benefits in them (except in patients with acute angina or myocardial infarction) (7-8). Frequent blood draws are one of the main or important causes of anemia in the intensive care unit, which can contribute significantly to anemia, especially during long stays. Tavindiranathan et al. concluded that recurrent bleeding is a contributing factor in the exacerbation of anemia (9). In another study, chant et al. examined the role of recurrent blood draws in the development of anemia in patients hospitalized for more than three weeks and concluded that recurrent

phlebotombs resulted in transfusion of compressed red blood cells in long term, which in turn is accompanied by potential side effects (10).

Accordingly, anemia is defined as a decrease in red blood cell mass and hemoglobin less than 12 g / dl and hematocrit less than 36% in women and hemoglobin less than 14 g / dl and hematocrit less than 41% in men and its clinical manifestations vary by the etiology, severity and speed of onset. Other underlying disorders, such as cardiopulmonary disease, may affect the severity of the symptoms. Severe anemia may be tolerated if it develops gradually, but patients with hemoglobin less than 7 g / dl usually show signs of tissue hypoxia including fatigue, headache, and shortness of breath, lightheadedness, and angina. Pallor, blurred vision, syncope, and tachycardia may be signs of hypovolemia that require immediate attention (11).

Anemia is a common problem in patients with critical condition and various causes have been suggested for this prevalence, including frequent blood draws for various biochemical and electrolyte tests, etc., as well as coagulation diseases, surgery, bone marrow disease, and cerebral suppression (12).

Pearl also cites inflammatory causes, recurrent blood draws, and gastrointestinal bleeding as causes of anemia (13). Above 50% of individuals hospitalized in ICU suffering from anemia at least once have blood draw (1). In the study by Van, the role of frequent blood draws in the occurrence of anemia along with other causes of anemia in patients has mentioned in the intensive care unit patients (14). A study by Chant et al. (2006) showed that the more blood samples taken from patients, the more the patients' hemoglobin levels decreased. For example, in patients with an average of 14 cc of daily blood draw for various tests,

after 22 days, the hemoglobin was about 8.8 ± 0.6 , while in patients with an average of 8 cc of blood draw, after 22 days, the hemoglobin was around 9.6 ± 0.1 . It was also shown in the same study that in the group with lower hemoglobin, more blood transfusions were performed and the mortality rate was higher than in the group with higher hemoglobin (23% mortality vs. 8%) (10). On the other hand, in a study that used two different methods for blood sampling in the intensive care unit conducted by Harber et al. (2006), in the first method, blood sampling was performed completely conservatively and in the second method, blood sampling was performed from patients in the usual way. In the conservative blood sampling group, the hemoglobin drop was from 12.7 to 11.5 and in the group that used the usual blood sampling method, the hemoglobin drop was from 13.7 to 11.7 (15).

Thomas's study noted that low hemoglobin levels were associated with higher organ dysfunction, higher mortality, and longer duration of hospitalization, but interestingly, contrary to other studies, no association was found between frequent blood sampling and anemia, although the prevalence of Anemia was reported 98% in patients admitted to the intensive care unit (16).

Blood transfusions and the use of erythropoietin are two methods used to correct anemia in critically ill patients (17). A large proportion of these patients have anemia at the time of admission and most of them also develop anemia during their stay in the ICU, so that with increasing the length of hospitalization in the ICU, the amount of anemia also increases (18).

Sekhon et al. (2012) reported that the mean of hemoglobin on the seventh day less than 9 g / dl in patients with severe brain trauma admitted to the ICU is accompanied by high mortality (19). Various studies have shown that 95% of patients in the third day of hospitalization in the ICU are with anemia (20). This complication may be due to the fact that patients with severe illness who need to be admitted to the ICU, in 90% of cases have low levels of iron and the capacity to connect to total iron and normal or slightly higher levels of normal ferritin (21, 8).

Despite the findings of Herbert et al. (1999) that showed the effect of maintaining hemoglobin in patients admitted to the ICU at the level of 8-9 g / dl is at least equal to the effect of maintaining this level at 10 g / dl with the aid of blood transfusion, blood infusion is still widely used for these patients (7) so that 50% of all these patients receive blood transfusions during their stay in the ICU due to this problem. Also, 85% of patients who have been hospitalized in the ICU for more than a week receive blood transfusions at least once (22, 23).

On the other hand, blood transfusions are not a safe process and can cause many problems for the recipient, especially when the person has other underlying problems that lead to his / her hospitalization in the ICU. Infection, immune response, pulmonary edema and resulting lung injury are just some of the risks associated with blood transfusions (24). Physical and mental symptoms such as dizziness, pain, confusion, etc. become evident in most patients. The illness interrupts the individual's daily functions, social activities, and peace of mind, and instead creates new issues for them (25). Policy Makers and

planners should be aware of the community health system, facilities and learning conditions, and know the community transition conditions with coordination of educational programs with community need changes(26).

METHODS

Anemia is a common finding in the intensive care unit and its severity increases with increasing hospitalization time and frequent blood sampling is a contributing factor in this regard. Exclusion criteria included age less than 16 years, pregnant women, History of moderate to severe anemia (hemoglobin less than 10) on arrival, acute hemorrhage, and hemorrhagic shock before or during hospitalization and burn patients who are treated late.

Using the specified form, the necessary information including medical diagnosis, hemoglobin and hematocrit levels on the first and last day of the patient during the hospitalization, daily blood volume and total blood volume of the patient were collected. In order to investigate the relationship between the sample volume and the amount of hemoglobin and hematocrit in patients, first the difference between the amount of hemoglobin and hematocrit at the time of admission to the ICU and the amount of hemoglobin and hematocrit in each patient on the last day of hospitalization were calculated.

This is a cross-sectional study that was performed on 104 patients admitted to the intensive care unit of Imam Ali Hospital in 2020 with the aim of determining the relationship between frequent blood sampling (number and volume of blood sampling) with anemia in patients in the intensive care unit. Demographic and clinical information of patients and information related to the amount of hemoglobin and hematocrit of blood, etc. were collected in the relevant checklist and after entering the information of the samples through SPSS software version 20, with descriptive statistical methods, the amount of hemoglobin and Hematocrit in ICU was statistically analyzed.

Findings: A total of 104 patients were enrolled in the study and the mean total blood volume obtained from the patients during the hospital stay was 55.4 ml (standard deviation 41.6).

In this study, the mean and standard deviation of hemoglobin at the beginning and the last day were 2.9 ± 11.9 and 2.08 ± 9.9 , respectively, and the mean and standard deviation of hematocrit on the first and last day were 37.3 ± 8.6 and 31.4 ± 6 , respectively. The patients studied in this study were diagnosed with burns, lung diseases, poisoning and gynecological diseases and other diseases and a statistically significant and negative difference was observed between hemoglobin and hematocrit on the last day and blood volume taken from patients (p values \leq 0.001).

Frequency and percentage of patients based on medical diagnosis in the ICU of Ali Ibn Abitaleb Hospital

Percentage	No.	Disease diagnosis
22.1%	23	Burns
14.4%	15	Lung disease
4.8%	5	Poisoning
6.7%	7	gynecological diseases
51.9%	54	Other
100%	104	Total

SD	Mean	Test parameter
2/9	11/9	HB1
8/6	37/3	HCT1
2/08	9/9	HB2
6/00	31/4	HCT2

DISCUSSION

In this study, the mean and standard deviation of hemoglobin at the beginning and the last day were 2.9 ± 11.9 and 2.08 ± 9.9 , respectively, and the mean and standard deviation of hematocrit on the first and last day were 37.3 ± 8.6 and 31.4 ± 6 , respectively.

The rate of decrease in hemoglobin after seven days in our study was 1.67 and this finding was similar to the findings of crowin et al.(8) They reported a decrease in hemoglobin as 11 ± 2.4 in the first day of hospitalization and 9.8 ± 1.6 as average of the seventh day and they reported the hemoglobin decrease as 1.2. The average daily blood draw volume in the present study was $4.78 + 1.53$, which was lower than the study of Chant et al. (10).

The mean blood draw volume in the study of Chant et al. (10) was $1.3 + 7.3$ cc. Also, the average daily blood draw volume in the study of Vincent et al. (25) was $41.1 + 39.7$, which in both studies was the average daily blood draw volume is higher than our study. The reason for this discrepancy can be explained by the fact that for the same test, for example, CBC, 1.5-2 cc of blood was needed in our study, while for the same test in the mentioned studies, the amount of 5-7 cc blood has been drawn.

It should be noted that most studies have not reported a significant relationship between age and hemoglobin depletion. In our study, no significant relationship was found between gender and a decrease in hemoglobin. This finding was similar to the findings of Herbert et al. (7).

In summary, it can be said that age, sex and underlying disease are not significantly associated with a decrease in hemoglobin and the findings of the present study are consistent with the findings of many studies in this field. However, the interesting thing about our study is that it strongly reports a significant association between frequent blood draws and a decrease in hemoglobin, so that the higher the average daily blood draw volume, the more the hemoglobin decreases. In our study, patients are divided into five groups in terms of the average daily blood draw volume so that the average daily blood draw volume increases from group one to group five. In addition to the fact that in general, with increasing the average daily blood draw volume, the rate of hemoglobin decrease was more, this was true also in comparison on each group with the next group. Nevertheless, in comparison between the fourth and fifth groups, this relationship was not significant. This finding can be explained by the fact that the number of patients in the fourth and fifth groups was less than the other three groups, and perhaps if there was a sufficient sample size in these two groups, the relationship between the two groups would be significant too. The findings of our study are consistent with the findings of the study of Chant et al. (10). In this study, with increasing the average daily blood draw volume, the rate of decrease in hemoglobin also increases. Patients collaboration is needed to draw blood samples. Mutual rights for people and meeting these

requirements is only possible through collaboration and respecting mutual rights(27).

In our study, the relationship between the mean number of daily blood draws and the rate of decrease in hemoglobin was significant, so that as the number of daily blood draws increased, the rate of decrease in hemoglobin also increased. To investigate this relationship, patients were divided into five groups whose mean number of daily blood draws was from group one to group five. In addition to the fact that this relationship was generally true, there was a significant relationship between each group and the next group, but this relationship was not significant between the fourth and fifth groups, which may still be due to the small number of patients in these two groups. Our study is similar to the study of Vincent et al. (28).

Health promotion behaviors include any action that is performed to increase or maintain the individual or group health and self-actualization (29).

CONCLUSION

Considering the effect of frequent blood draws (volume of blood draw per day and number of blood draw per day) on reducing hemoglobin in patients in the intensive care unit and the negative effect of anemia on the prognosis of the disease, it is reasonable to prevent unnecessary and frequent blood draws using practical approaches so that hemoglobin decreases in hospitalized patients is reduced.

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