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### RESEARCH ARTICLE

## IMPACT OF ANEMIA AT ADMISSION TO INTENSIVE CARE ON PATIENT COMPLICATIONS AND OUTCOMES

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### Abstract

**Background:** Anemia at ICU admission is a common biological abnormality associated with increased risks of complications, morbidity, and mortality. It results from complex mechanisms including erythropoietin synthesis alterations and iron metabolism disturbances.

**Objective:** This study aimed to analyze the epidemiological, clinical, and prognostic profiles of patients with anemia at admission to the surgical ICU to understand its impact on outcomes and identify optimal management strategies.

**Methods:** This was a retrospective, descriptive, and analytical study conducted over a one-year period (January to December 2023) at the Surgical ICU, Pavilion 17, CHU Ibn Rochd, Casablanca. A total of 70 patients were included. Demographic, clinical, biological (Hb, CRP, ferritin), and outcome data were collected. Statistical analysis was performed using SPSS.

**Results:** Among the 70 patients, 43 (62%) were anemic at admission. The population was predominantly male (65%), aged 25–64 years (65%). Anemic patients showed significantly higher CRP levels (197 vs 182 mg/L,  $p=0.003$ ) and more frequent hyperleukocytosis ( $p=0.04$ ). Nosocomial infections were significantly more frequent in the anemic group ( $p=0.03$ ). Anemia was associated with prolonged ICU stay ( $10 \pm 7$  vs  $5 \pm 4$  days,  $p<0.001$ ) and longer mechanical ventilation duration (6 vs 4 days,  $p=0.013$ ). Blood transfusions were exclusively required for anemic patients ( $p<0.001$ ). Favorable outcomes were observed in 70% of anemic patients, with a 30% mortality rate.

**Conclusion:** Anemia at ICU admission is a key determinant of patient prognosis. Early identification and optimized management are essential to improve clinical outcomes in this vulnerable population.

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### Introduction:-

Anemia is a concerning clinical condition, particularly in intensive care settings, where it significantly impacts patient morbidity and mortality. Patients admitted to the ICU often face complex comorbidities that exacerbate the risk of anemia. Its pathophysiology relies on impaired erythropoietin synthesis and major disturbances in iron

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metabolism. Large-scale prospective studies have shown a high prevalence of anemia among ICU patients, with hemoglobin levels often below 10 g/dL in a significant proportion of cases. Anemia frequently worsens during the ICU stay, leading to a substantial requirement for blood transfusions. This condition is associated with an increased risk of complications, including respiratory and neurological issues, affecting both immediate morbidity and long-term prognosis. The primary objective of this work was to evaluate the impact of anemia on the prognosis and outcome of patients admitted to our ICU service. Secondary objectives included identifying factors associated with anemia in this population, analyzing the relationship between anemia severity and clinical results, and evaluating anemia-related complications, specifically their influence on ICU length of stay and mortality rates.

## Methods:-

### Study Design and Setting:-

This was a retrospective, descriptive, and analytical study conducted at the Surgical Intensive Care Unit, Pavilion 17, CHU Ibn Rochd, Casablanca, Morocco. The study spanned a one-year period from January 2023 to December 2023.

### Study Population:-

The study included 70 patients admitted to the surgical ICU during the study period with a documented diagnosis of anemia at admission. Exclusion criteria were patients with insufficient data, those with a history of chronic anemia (e.g., sickle cell disease, thalassemia) or malignant hematological disorders, and those who received massive transfusions prior to ICU admission.

### Data Collection:-

Parameters were collected from medical records using a standardized form. Variables included demographic data (age, sex), biological parameters (hemoglobin, hematocrit, ferritin, C-reactive protein, mean corpuscular volume, reticulocyte count), severity scores (APACHE II, Glasgow Coma Scale), length of stay, complications (sepsis, multi-organ failure, nosocomial infections), specific treatments (blood transfusions, iron/vitamin B12 supplementation, erythropoietin), and patient outcome (survival, death).

### Statistical Analysis:-

Qualitative variables were expressed as percentages. Quantitative variables were presented as mean  $\pm$  standard deviation. Statistical analysis was performed using SPSS software. Comparisons between anemic and non-anemic patients were conducted regarding mortality risk, morbidity (complications), and ICU length of stay.

## Results:-

### Patient Characteristics:-

Of the 70 patients analyzed, 43 (62%) were anemic at admission and 27 were not. The majority were aged 25–64 years (65%), with ages ranging from 15 to 85 years. A male predominance was observed (65% male, 35% female), with a sex ratio of 1.86. Geographic distribution showed an urban predominance (84%). Most patients (71%) had no comorbidities; the most frequent were diabetes (7%) and hypertension (6%).

### Factors Associated with Anemia:-

No significant differences were observed between anemic and non-anemic groups regarding age, sex, or comorbidities (Table 1).

**Table 1: Socio-economic factors and comorbidities associated with anemia**

| Factors                 | Anemia YES (n=43) | Anemia NO (n=27) | P-value |
|-------------------------|-------------------|------------------|---------|
| Age (years); M $\pm$ SD | 47                | 48 $\pm$ 18      | 0.433   |
| Female Sex              | 35%               | 32%              | 0.20    |
| Male Sex                | 65%               | 68%              | 0.53    |
| Hypertension            | 6%                | 4%               | 0.084   |
| Diabetes                | 7%                | 6%               | 0.080   |

Biological data revealed a significant association between anemia and elevated CRP ( $p=0.003$ ) and hyperleukocytosis ( $p=0.04$ ) (Table 2).

**Table 2: Biological factors associated with anemia**

| Paraclinical Data   | Anemia YES (n=43) | Anemia NO (n=27) | P-value |
|---------------------|-------------------|------------------|---------|
| CRP (mean)          | 197(125)          | 182(128)         | 0.003   |
| Ferritin (elevated) | 23                | 15               | 0.32    |
| Hypernatremia       | 6                 | 4                | 0.92    |
| Hypokalemia         | 5                 | 4                | 1.00    |
| Hyperleukocytosis   | 36                | 9                | 0.04    |

**Complications and Outcomes:-**

Anemic patients showed a significantly higher transfusion rate ( $p<0.001$ ) and longer mechanical ventilation duration ( $p=0.013$ ) (Table 3).

**Table 3: Therapeutic data and impact on mechanical ventilation**

| Variable                         | Anemia YES (n=43) | Anemia NO (n=27) | P-value  |
|----------------------------------|-------------------|------------------|----------|
| Transfusion; n                   | 14                | 0                | $<0.001$ |
| Mechanical ventilation; n        | 18                | 8                | 0.056    |
| Mean ventilation duration (days) | 6 (5.5-8)         | 4 (3-7)          | 0.013    |

Nosocomial infections were significantly more frequent in the anemic population ( $p=0.03$ ) (Table 4).

**Table 4: Complications associated with anemia**

| Complications        | Anemia YES (n=43) | Anemia NO (n=27) | P-value |
|----------------------|-------------------|------------------|---------|
| Septic shock         | 1                 | 0                | 0.56    |
| ARDS                 | 5                 | 3                | 0.28    |
| Nosocomial infection | 17                | 4                | 0.03    |
| Mortality            | 13                | 4                | 0.067   |

ICU length of stay was significantly longer for anemic patients ( $10\pm 7$  days vs  $5\pm 4$  days,  $p<0.001$ ) (Table 5).

**Table 5: Length of stay associated with anemia**

| ICU Stay (days); Mean(QR) | Anemia YES (n=43) | Anemia NO (n=27) | P-value  |
|---------------------------|-------------------|------------------|----------|
| Prolonged length of stay  | $10 \pm 7$        | $5 \pm 4$        | $<0.001$ |

**Discussion:-**

This study confirms the significant impact of anemia at ICU admission on patient outcomes. The observed anemia prevalence (62%) in our 70-patient sample is consistent with other ICU studies. Our results highlight an association between anemia and inflammatory markers (elevated CRP, hyperleukocytosis), suggesting that inflammation plays a central role in ICU anemia pathophysiology, particularly through iron metabolism alterations. The significant increase in nosocomial infections among anemic patients is a key finding. Anemia may compromise immune function, increasing infection vulnerability, which likely contributes to prolonged stays and increased morbidity.

Longer ICU stays and increased mechanical ventilation duration in anemic patients indicate higher clinical severity, matching studies showing anemia as an independent risk factor for prolonged hospitalization. Exclusive transfusion requirements for anemic patients emphasize the need for careful management. While no statistically significant association between anemia and mortality was found ( $p=0.067$ ), the observed trend suggests a clinical impact that might reach significance with a larger sample. Other studies have established anemia as an ICU mortality risk factor.

**Conclusion:-**

Anemia at surgical ICU admission is a key determinant of patient prognosis at CHU Ibn Rochd. It is associated with increased inflammatory response, higher nosocomial infection incidence, prolonged stay, and increased mechanical ventilation dependence. Early identification and optimized management are essential to improve clinical outcomes in this vulnerable population.

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