

DOI: 10.59715/pntjimp.4.3.8

Prevalence of anemia in patients before thoracic surgery at Binh Dan Hospital

Vu Duc Hop¹, Truong Sang Kien^{1,2}

¹Pham Ngoc Thach University of Medicine

²Binh Dan Hospital

Abstract

Background: Preoperative anemia is a common condition affecting approximately one-third of patients and is associated with an increased risk of blood transfusion, prolonged hospital stay, and higher postoperative mortality. In thoracic surgery, preoperative anemia has been shown to increase the risk of mortality by 1.6 times compared to patients without anemia. This study aims to determine the prevalence of anemia before thoracic surgery and its association with postoperative adverse events.

Method: This was a retrospective descriptive study conducted on 54 patients who underwent elective thoracic surgery at Binh Dan Hospital from January 1, 2023, to December 31, 2023.

Results: The prevalence of preoperative anemia in thoracic surgery was 39%, with all cases classified as mild anemia. Patients with anemia experienced significantly longer hospital stays compared to those without anemia ($p < 0.05$). The study did not identify any significant increase in other adverse outcomes in anemic patients compared to non-anemic patients ($p > 0.05$).

Conclusions: Preoperative anemia in thoracic surgery accounted for 39% of cases and was significantly associated with prolonged hospitalization.

Keywords: Preoperative anemia, thoracic surgery.

Received: 21/11/2024

Revised: 21/5/2025

Accepted: 20/7/2025

Author contact:

Vu Duc Hop

Email:

vuhop255@gmail.com

Phone: 0976796500

1. INTRODUCTION

Anemia is one of the most common hematologic abnormalities in patients undergoing surgery.[1] Preoperative anemia, regardless of severity, is associated with increased risk of blood transfusion, prolonged hospital stay, and higher postoperative mortality rates.[2,3] Additionally, blood transfusion itself is considered an independent risk factor that may worsens clinical outcomes post-surgery.[4] Specifically, preoperative anemia in thoracic surgery increases the risk of mortality by 1.6 times compared to non-anemic patients.[5]

In practice, data on preoperative anemia rates in thoracic surgery worldwide and in Vietnam remain limited. In Vietnam,

anemia in general and preoperative anemia in thoracic surgery in particular have not been sufficiently studied. Most of the available data are derived from broader nutritional studies.[6,7] Currently, no published studies have specifically addressed preoperative anemia in thoracic surgery in Vietnam.

Based on these points, we conducted the study titled “Survey on Preoperative Anemia Rates in Thoracic Surgery” to:

- Assess the prevalence of preoperative anemia among patients undergoing thoracic surgery patients.
- Investigate the correlation between preoperative anemia and adverse postoperative outcomes.

2. STUDY SUBJECTS AND METHODS

2.1. Study subjects

All subjects were retrospectively selected from medical records of patients who underwent elective thoracic surgery at Binh Dan Hospital from January 1, 2023 to December 31, 2023. Cases with missing or untraceable data were excluded.

2.2. Research methods

- **Study design:** Cross-sectional study.
- **Sample size:** Calculated using proportion estimation formulas and adjusted for finite population. Sample size formula for estimating a proportion:

$$n_i = \frac{z^2_{(1-\frac{\alpha}{2})} p(1-p)}{d^2}$$

Adjust sample size for finite population:

$$n = \frac{n_i}{1 + \frac{n_i}{N}}$$

Sample size formulas and correction for finite population were applied using data from two studies:

- Study by Ayten Saraçoğlu et al. reported preoperative anemia rate of 43.9% → $n_i = 148$ → with $N=84$, $n=54$.
- Study by Çiğdem Yıldırım Güçlü et al. reported postoperative complication rate of 26% → $n_i = 116$ → with $N=84$, $n=49$. → Thus, final sample size selected: $N=54$, satisfying both study objectives.
- **Sampling method:** Purposive sampling, selecting subjects meeting inclusion and exclusion criteria.

Research variables

- **Primary variable:**
 - **Anemia (binary):** 1.Yes; 2.No
- Defined per WHO criteria:

- Anemia: Hb <120 g/L (female) or <130 g/L (male).
- No anemia: Remaining Hb levels.
- **Secondary variables:**
 - **Anemia severity (ordinal):**
 - Mild: Hb 90–120 g/L
 - Moderate: Hb 60–89 g/L
 - Severe: Hb 30–59 g/L
 - Very severe: Hb <30 g/L
 - **RBC morphology (qualitative):**
 - Based on MCV and MCHC values:
 - MCV <80 fl: Microcytic
 - MCV 80–100 fl: Normocytic
 - MCV >100 fl: Macrocytic
 - MCHC <320 g/L: Hypochromic
 - MCHC 320–360 g/L: Normochromic
 - **Serum ferritin test (binary):**
 - 1.Yes; 2.No
 - Presence or absence of test result confirming WHO-anemia diagnosis.
 - **Blood transfusion (binary):**
 - 1.Yes; 2.No
 - Based on medical record documentation.
 - **Mortality (binary):** 1.Yes; 2.No
 - Within 30 days post-surgery.
 - **Surgical site infection (binary):**
 - 1.Yes; 2.No
 - Diagnosed by physicians and documented in records.
 - **Hospital stay duration (discrete):**
 - Number of days.
 - **ICU stay duration (discrete):**
 - Number of days.
 - **Chest drain removal time (discrete):**
 - Number of days.
 - **Baseline variables:**
 - **Age (discrete)**
 - **Gender (binary)**
 - **BMI (continuous)**
 - **ASA score (ordinal, I–III)**
 - **Number of comorbidities (ordinal: 0, 1–2, ≥3)**
 - **Type of surgery (qualitative)**

2.3. Data processing

- Data entered using Microsoft Excel 365, analyzed with R software.
- Normally distributed quantitative variables: Mean \pm SD
- Non-normally distributed variables: Median (IQR)
- Qualitative variables: Percentages
- Statistical tests used:
 - Mann-Whitney U (non-parametric)
 - T-test (parametric)
 - Chi-square and Fisher's Exact (qualitative comparison)
 - $p \leq 0.05$ considered statistically significant.

2.4. Ethics

- Approved by the Biomedical Research Ethics Committee of Pham Ngoc Thach Medical University (Decision No. 1064/TĐHYKPNT-HĐĐĐ, dated March 6, 2024).
- Approved by Binh Dan Hospital's Board of Directors.

3. STUDY RESULTS

From January 1, 2023 to December 31, 2023, our study record that 21 among 54 patients (39%) have preoperative anemia before thoracic surgery via WHO criteria [8]

Patients were divided into two groups: anemic and non-anemic.

Table 1. Comparison between anemic and non-anemic groups

| Demographic characteristics | n=54 | | |
|---------------------------------|----------------------|-------------------|------------------------|
| | Non-anemia
(n=33) | Anemia
(n=21) | P value |
| Gender, n (%) | | | |
| Male | 19 (57.6) | 15 (71.4) | 0.304 ^(*) |
| Female | 14 (42.4) | 6 (28.6) | |
| Age(year) | | | |
| Mean \pm SD | 61.58 \pm 11.53 | 58.24 \pm 12.34 | 0.318 ^(***) |
| Age group, n (%) | | | |
| 18-30 | 1 (3) | 1 (4.8) | 0.815 ^(**) |
| 31-45 | 1 (3) | 1 (4.8) | |
| 45-60 | 14 (42.4) | 11 (52.4) | |
| > 60 | 17 (51.5) | 8 (38.1) | |
| BMI (kg/m²) | | | |
| Mean \pm SD | 22.38 \pm 3.36 | 20.46 \pm 3.14 | 0.04 ^(***) |
| BMI group, n (%) | | | |
| < 18.5 | 5 (15.2) | 6 (28.6) | 0.217 ^(**) |
| 18.5-22.9 | 16 (48.5) | 10 (47.6) | |
| 23-24.9 | 4 (12.1) | 4 (19) | |
| > 25 | 8 (24.2) | 1 (4.8) | |
| Comorbidities, n (%) | | | |
| 0 | 13 (39.4) | 5 (23.8) | 0.477 ^(**) |
| 1-2 | 16 (48.5) | 12 (57.1) | |
| ≥ 3 | 4 (12.1) | 4 (19) | |
| ASA, n (%) | | | |
| I | 0 | 0 | 0.123 ^(**) |
| II | 27 (81.8) | 13 (61.9) | |
| III | 6 (18.2) | 8 (38.1) | |

Mean \pm SD: Mean \pm Standard deviation

*/**: Chi-square Test/ Fisher's Exact Test

***: T-test

When collecting data retrospectively from the medical records of 54 patients who underwent elective thoracic surgery at Binh Dan Hospital, we found that there was only a significant difference in BMI between the anemic and non-anemic groups prior to surgery ($p = 0.04 < 0.05$). Apart from this, no significant differences were observed between the two groups in terms of gender, age, age group, BMI category, comorbidities, ASA score, or type of surgery ($p > 0.05$).

All patients underwent thoracic surgery via video-assisted thoracoscopic surgery (VATS). Types of surgery included: pulmonary tumor resection, lobectomy, pulmonary bulla removal, mediastinal tumor resection, and pleural biopsy. No significant difference in surgery type distribution between each groups ($p=0.867$).

Table 2. Anemia characteristics

| Anemia characteristics | n=21 |
|-----------------------------------|----------|
| Anemia severity, n (%) | |
| Mild anemia | 21 (100) |
| RBC morphology, n (%) | |
| Normochromic, normocytic | 17 (81) |
| Microcytic, hypochromic | 1 (4.8) |
| Microcytic, normochromic | 2 (9.5) |
| Normocytic, hypochromic | 1 (4.8) |
| Serum ferritin test, n (%) | |
| Yes | 0 (0) |
| No | 21 (100) |

In this survey, 100% of patients with preoperative anemia before thoracic surgery had mild anemia, with normochromic normocytic anemia being the most common type (81%). Additionally, the proportion of anemic patients who underwent serum ferritin testing was 0%.

Table 3. Comparison of Outcomes Between Patient Groups Based on Anemia Status

| | Anemia | | P value |
|--|----------------------|------------------|-----------------------|
| | Non-anemia
(n=33) | Anemia
(n=21) | |
| Blood transfusion, n (%) | | | |
| Yes | 0 (0) | 1 (4.8) | 0.389 ^(*) |
| No | 33 (100) | 20 (95.2) | |
| Mortality, n (%) | | | |
| Yes | 0 (0) | 0 (0) | |
| No | 33 (100) | 21 (100) | |
| Surgical site infection, n (%) | | | |
| Yes | 0 (0) | 1 (4.8) | 0.389 ^(*) |
| No | 33 (100) | 20 (95.2) | |
| Hospital stay duration (days) | | | |
| Median (IR) | 7 (7-8.5) | 8 (8-9.5) | 0.044 ^(**) |
| ICU stay duration (days) | | | |
| Median (IR) | 0 | 0 | |
| Chest drain removal time (days) | | | |
| Median (IR) | 4 (3-5) | 4 (3-5.5) | 0.785 ^(**) |

IR: interquartile range

*: Chi-square Test

** : Mann-Whitney U Test

When comparing the two groups those with and without preoperative anemia among the adverse postoperative

outcomes, only the length of hospital stay showed a significant difference between the two groups ($p < 0.05$).

4. DISCUSSION

Our study, conducted by retrospectively reviewing the medical records of 54 patients who underwent elective thoracic surgery at Binh Dan Hospital from January 1, 2023, to December 31, 2023, recorded a prevalence of preoperative anemia as defined by WHO criteria [8] of 39% (21/54 patients).

Preoperative anemia is a significant risk factor. It has been shown to be an independent predictor of increased one-year mortality in a cohort of 319,703 non-cardiac surgery patients. Preoperative anemia is also independently associated with early postoperative complications, such as higher 30-day morbidity following non-cardiac surgery.[9] This is especially critical in thoracic surgery patients, who are exposed to factors that can impair oxygen delivery, including one-lung ventilation, reduced lung volume, postoperative pain-related hypoventilation, and intraoperative bleeding. These factors contribute to a higher risk of blood transfusion and increased postoperative mortality.[5,10]

In our study, there was a statistically significant difference in BMI between the anemic and non-anemic groups prior to thoracic surgery. This suggests a potential link between BMI, nutritional status, and anemia in thoracic surgery patients. This raises the question: Could improving patients' BMI through nutritional intervention prior to surgery help reduce the incidence of preoperative anemia? This question warrants further investigation in broader studies.

The most common causes of preoperative anemia include iron-deficiency anemia and anemia of chronic disease/inflammation.[9,11] Iron-

deficiency anemia can be screened using serum ferritin testing in patients diagnosed with microcytic, hypochromic anemia, and can be promptly treated with oral iron supplementation during the preoperative waiting period.[12] This strategy is also among the urgent recommendations proposed by the WHO.[13] In our study, none of the anemic patients underwent serum ferritin testing. A possible explanation for this is that the majority of anemic patients in our study had normocytic, normochromic anemia (17 out of 21 patients, or 81%), while only 1 out of 21 patients (4.8%) had microcytic, hypochromic anemia. This highlights the limited attention given to the evaluation and management of preoperative anemia in thoracic surgery in Vietnam.

Managing preoperative anemia is crucial. For instance, in 2013, Farmer et al. reported outcomes from a five-year preoperative anemia management program in Western Australia, starting in 2008. The program was effective in reducing adverse postoperative events such as mortality, infections, cardiovascular complications, length of hospital stay, blood transfusions, and also lowered healthcare costs.[14] Based on this, we propose implementing a screening program for iron-deficiency anemia in preoperative anemic patients undergoing thoracic surgery in future studies, and evaluating its impact on postoperative outcomes.

In our study, only the length of hospital stay was significantly longer in the anemic group compared to the non-anemic group. Blood plays a key role in transporting oxygen, nutrients, and metabolic products to tissues, which is essential for postoperative recovery. Anemia reduces

this delivery, potentially contributing to delayed recovery and longer hospital stays.[15] The statistical difference in hospital stay duration approached the significance threshold ($p = 0.05$), suggesting that larger sample sizes are needed to more clearly determine the effect of anemia on hospitalization time.

Additionally, the study did not find any association between anemia and other adverse postoperative outcomes. However, this study's retrospective and single center design, along with its small sample size limits its ability to draw definitive conclusions. As a result, the findings cannot be generalized to the broader thoracic surgery population. Moreover, since our sample consisted solely of elective thoracic surgery patients, it does not fully represent the entire population undergoing thoracic surgery. Therefore, we recommend conducting larger, multicenter prospective studies to more accurately assess the relationship between anemia and postoperative outcomes in thoracic surgery patients.

5. CONCLUSIONS

The prevalence of preoperative anemia in thoracic surgery patients in our study was relatively high, at 39%. This study did not find a statistically significant association between preoperative anemia and adverse outcomes such as blood transfusion, mortality, surgical site infection, prolonged chest drain duration, or extended ICU stay. However, anemia was associated with lower patient BMI and contributed to longer hospital stays, thereby indirectly increasing treatment costs. We recommend that preoperative anemia management in thoracic surgery patients is necessary and should be

implemented in the near future. This approach aligns with the World Health Organization's Global Patient Blood Management Initiative[13] and may improve both clinical outcomes and resource utilization.

REFERENCES

1. Muñoz M, Acheson AG, Auerbach M, et al. International consensus statement on the peri- operative management of anaemia and iron deficiency. *Anaesthesia*. 2017;72(2):233-247. doi:10.1111/anae.13773
2. Baron DM, Hochrieser H, Posch M, et al. Preoperative anaemia is associated with poor clinical outcome in non-cardiac surgery patients. *British journal of anaesthesia*. 2014;113(3):416-423. doi:10.1093/bja/aeu098
3. Beattie WS, Karkouti K, Wijeyesundera DN, Tait G. Risk associated with preoperative anemia in noncardiac surgery: a single-center cohort study. *The Journal of the American Society of Anesthesiologists*. 2009;110(3):574-581. doi:10.1097/ALN.0b013e31819878d3
4. Ferraris VA, Davenport DL, Saha SP, Austin PC, Zwischenberger JB. Surgical outcomes and transfusion of minimal amounts of blood in the operating room. *Archives of Surgery*. 2012;147(1):49-55. doi:10.1001/archsurg.2011.790
5. Liu Y, Bai Y-P, Zhou Z-F, Jiang C-R, Xu Z, Fan X-X. Preoperative anemia as a prognostic factor in patients with lung cancer: a systematic review and meta-analysis of epidemiological studies. *Journal of Cancer*. 2019;10(9):2047. doi:10.7150/jca.29410

6. Bùi Thị Duyên, Nguyễn Quang Dũng. Tình trạng dinh dưỡng trước và sau phẫu thuật của người bệnh phẫu thuật đường tiêu hóa tại Bệnh viện quân Y 175 năm 2020. Tạp chí Dinh dưỡng và Thực phẩm. 2021;17(2):35-45. doi:10.56283/1859-0381/73
7. Ngô Thị Linh. Tình trạng dinh dưỡng và một số yếu tố liên quan ở bệnh nhân phẫu thuật ung thư đường tiêu hóa tại bệnh viện hữu nghị việt đức năm 2019. Trường đại học y Hà Nội; 2020. <https://sti.vista.gov.vn/tw/Lists/TaiLie uKHCN/Attachments/305828/CVv417 S572020083.pdf>
8. WHO. Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Accessed November 10, 2023. <https://www.who.int/publications/i/item/WHO-NMH-NHD-MNM-11.1>
9. Greenberg JA, Zwiep TM, Sadek J, et al. Clinical practice guideline: evidence, recommendations and algorithm for the preoperative optimization of anemia, hyperglycemia and smoking. Canadian Journal of Surgery. 2021;64(5):E491.
10. Saraçoğlu A, Gungor Arslan D, Laçın T, et al. The Effect of Preoperative Anemia on Postoperative Morbidity and Mortality in Patients Undergoing Thoracic Surgery. Journal of Cardio-Vascular-Thoracic Anaesthesia and Intensive Care Society. 2020;26(4):197-203. doi:10.5222/GKDAD.2020.73644
11. Klein A, Collier T, Brar M, et al. The incidence and importance of anaemia in patients undergoing cardiac surgery in the UK—the first Association of Cardiothoracic Anaesthetists national audit. Anaesthesia. 2016;71(6):627-635.
12. Quyết định số 1832/QĐ-BYT Hướng dẫn chẩn đoán, điều trị một số bệnh lý huyết học (Bộ y tế) 10-11 (2022).
13. Organization WH. The urgent need to implement patient blood management: policy brief. World Health Organization; 2021.
14. Farmer SL, Towler SC, Leahy MF, Hofmann A. Drivers for change: Western Australia patient blood management program (WA PBMP), world health assembly (WHA) and Advisory Committee on blood safety and availability (ACBSA). Best Practice & Research Clinical Anaesthesiology. 2013;27(1):43-58.
15. Lin RJ, Evans AT, Chused AE, Unterbrink ME. Anemia in general medical inpatients prolongs length of stay and increases 30-day unplanned readmission rate. Southern medical journal. 2013;106(5):316.