RESEARCH PAPER

Evaluation of Anemia in Geriatric population in a tertiary care centre A prospective observational cross-sectional study

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ABSTRACT

Background: Anemia, a major global health concern, particularly among the elderly, where it is frequently underdiagnosed despite its association with increased morbidity, functional decline, and mortality. The condition is multifactorial in origin, often influenced by nutritional deficiencies, chronic diseases, and age-related physiological changes. Data on the clinical epidemiology of geriatric anemia in South India remain limited.

Aim: To evaluate the prevalence, morphological patterns, etiological profile, severity, and clinical characteristics of anemia among elderly patients in a tertiary care setting.

Materials and Methods: This prospective observational cross-sectional study was conducted in the Department of Pathology at Chettinad Hospital and Research Institute, Chennai, from December 2025 to February 2026. A total of 332 patients aged ≥60 years meeting WHO criteria for anemia were included. Detailed clinical history, comorbidity profile, and hematological parameters were recorded. Peripheral smear examination and red cell indices were used for morphological classification. Additional investigations including iron studies, vitamin B12, folate levels, and organ function tests were performed selectively. Data were analyzed using descriptive statistics and Chi-square test, with $p < 0.05$ considered significant.

Results: The mean age of participants was 68.4 ± 6.7 years, with a female predominance (57.8%). Moderate anemia was most common (48.8%), followed by mild (35.8%) and severe anemia (15.4%). Normocytic normochromic anemia was the predominant morphological type (44.6%), followed by microcytic hypochromic (37.9%) and macrocytic anemia (17.5%). Anemia of chronic disease was the leading etiology (33.7%), followed by iron deficiency anemia (29.5%), chronic kidney disease-related anemia (13.3%), and megaloblastic anemia (11.4%). Generalized weakness (85.5%) and fatigue (78.6%) were the most common symptoms. A high burden of comorbidities was observed, with hypertension (59.6%) and diabetes mellitus (53.0%) being the most prevalent.

Conclusion: The high prevalence of comorbidities and multifactorial etiologies highlights the need for comprehensive evaluation and early intervention. Even mild anemia should not be overlooked, as timely diagnosis and targeted management can substantially improve quality of life and clinical outcomes in the elderly population.

Keywords: Anemia, Geriatric, Hemoglobin, Peripheral smear, MCV, Iron deficiency, chronic disorder.

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INTRODUCTION

Anemia represents one of the most significant global health challenges, affecting approximately one-third of the world's population and disproportionately burdening older adults. Defined by the World Health Organization (WHO) as a hemoglobin (Hb) concentration below 13 g/dL in

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adult males and below 12 g/dL in adult non-pregnant females, anemia in the elderly constitutes a critical syndrome that is frequently overlooked in routine clinical practice [1].

The global burden of anemia in the aging population is substantial. A systematic review of 34 studies demonstrated that in individuals aged >65 years, the prevalence of anemia was 12% among community-dwelling persons, 40% among hospitalized patients, and 47% among nursing home residents, with an overall mean prevalence of 17% [2]. This prevalence rises sharply with advancing age, with reports indicating a prevalence exceeding 20% in individuals aged 85 years and above [3]. In the Indian subcontinent, geriatric anemia presents an even more pressing concern given the rapidly aging population, high burden of nutritional deficiencies, and the rising prevalence of chronic diseases.

For many decades, anemia in older persons was incorrectly perceived as either an insignificant finding or an inevitable consequence of physiological aging. This perspective led to its chronic underdiagnosis and inadequate management. However, contemporary evidence robustly refutes this assumption: anemia in the elderly is now recognized as an independent predictor of increased morbidity, functional decline, cognitive impairment, falls, prolonged hospitalization, and mortality [4, 5].

The pathophysiology of anemia in the geriatric population is inherently complex and multifactorial. Three broad etiological categories predominate: (1) nutritional deficiency anemia primarily due to iron, vitamin B12, and folate deficiency; (2) anemia of chronic disease (ACD), encompassing chronic inflammatory states, renal insufficiency, and malignancy; and (3) unexplained anemia of aging, hypothesized to arise from erythropoietin (EPO) deficiency, progressive EPO resistance of bone marrow erythroid progenitors, and chronic subclinical inflammation [6]. In many elderly patients, these etiologies co-exist, rendering morphological classification alone insufficient for definitive diagnosis.

From a clinical standpoint, the common presenting symptoms of geriatric anemia are generalized weakness, fatigue, exertional dyspnea, and palpitations that overlap considerably with non-specific manifestations of aging and comorbid conditions such as diabetes mellitus, hypertension, congestive heart failure, and chronic obstructive pulmonary disease. This symptomatic overlap creates a clinical diagnostic vacuum, wherein anemia is either missed or attributed to aging rather than treated as an independently correctable pathological state.

Moreover, the functional consequences of even mild anemia in the elderly are clinically meaningful. Studies have demonstrated that increasing functional deterioration is inversely and linearly correlated with decreasing hemoglobin concentration [7]. Anemia has been associated with an increased incidence of cardiovascular disease, cognitive impairment and dementia, decreased physical performance, muscle weakness, and a heightened risk of falls and fractures [8]. Importantly, an association between anemia and depressive symptoms has also been documented, adding a significant neuropsychiatric dimension to the syndrome.

The present study was therefore conceived to address the existing knowledge gap regarding the clinical epidemiology of geriatric anemia in a South Indian tertiary care setting. By systematically evaluating the prevalence, morphological types, etiological profile, and severity of anemia among patients aged 60 years and above, this study aims to generate actionable data that may improve clinical vigilance, guide diagnostic protocols, and inform targeted therapeutic interventions for this vulnerable population.

METHODOLOGY

Study Design and Setting

This is a prospective observational cross-sectional study conducted at the Department of Pathology, Chettinad Hospital and Research Institute, Chennai, Tamil Nadu, India. The study was carried out over a period of three months, from December 2025 to February 2026.

Ethical Approval and Informed Consent

Institutional ethics committee approval was obtained prior to commencement of the study (Proposal ID: IHEC-I/101/11/2025). Written informed consent was obtained from all participants. The study was conducted in accordance with the principles outlined in the the Indian Council of Medical Research (ICMR) guidelines for biomedical research on human participants. Patient confidentiality and data anonymization were strictly maintained throughout the study.

Study Population

A total of 332 elderly patients (aged >60 years) of both sexes attending the Clinical Pathology and Haematology sections of the institution for routine investigations were included in the study. Both outpatient and inpatient referrals were considered.

Inclusion Criteria

All elderly patients aged >60 years of both sexes presenting for routine hematological evaluation.

Hemoglobin (Hb) <12 g/dL in females and <13 g/dL in males satisfying WHO criteria for anemia.

Willingness to provide informed consent.

Exclusion Criteria

Patients with a history of acute blood loss (e.g., surgery or severe trauma).

Patients who received blood transfusion within the preceding three months.

Patients currently on chemotherapy or radiotherapy.

Clotted or inadequate blood samples.

All men and women aged less than 60 years.

Data Collection

A structured, pre-validated proforma was employed for data collection. Demographic details including age, sex, and residential background were recorded. A comprehensive clinical history was elicited through a direct patient interview, covering the nature and duration of anemic symptoms (fatigue, weakness, exertional dyspnea, palpitations, and dizziness), dietary history, family history, medication history, alcohol and tobacco use, and relevant comorbidities including diabetes mellitus, hypertension, chronic kidney disease, cardiac disease, and malignancy.

Laboratory Investigations

Blood samples were collected under aseptic precautions using standardized venipuncture techniques. The following hematological parameters were analyzed for all enrolled patients: hemoglobin (Hb), total leukocyte count (TLC), differential leukocyte count (DLC), mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular hemoglobin (MCH), packed cell volume (PCV), platelet count, and red cell distribution width (RDW). Peripheral blood smear examination was performed in all cases using Leishman stain to assess red cell morphology.

Based on MCV values, anemia was classified morphologically as: microcytic (<80 fL), normocytic (80–100 fL), or macrocytic (>100 fL). Severity of anemia was graded as: mild (Hb 10–12 g/dL in females, 10–13 g/dL in males), moderate (Hb 7–10 g/dL), or severe (Hb <7 g/dL). Further investigations including serum ferritin, serum iron, total iron-binding capacity (TIBC), serum vitamin B12, serum folate, reticulocyte count, renal function tests (blood urea nitrogen, serum creatinine), liver function tests, thyroid function tests, and bone marrow aspiration were performed selectively based on initial findings to establish the etiology.

Statistical Analysis

All collected data were entered into Microsoft Excel 2019. Descriptive statistics including frequencies, percentages, means, and standard deviations were computed. Categorical variables were expressed as numbers and percentages. Continuous variables were expressed as mean ± standard deviation. Association between categorical variables was assessed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

Age and Sex Distribution

Of the 332 patients enrolled, 192 were females (57.8%) and 140 were males (42.2%). The mean age of the study population was 68.4 ± 6.7 years (range: 60–92 years). The highest number of anemic patients was observed in the 60–70 year age group (n=189, 56.9%), followed by the 71–80 year age group (n=109, 32.8%), and those above 80 years (n=34, 10.3%).

Table 1: Age and Sex Distribution of Study Participants

Age Group (Years)	Females (n)	males (n)	Total (n)	Percentage (%)
60–70	110	79	189	56.9
71–80	60	49	109	32.8
>80	22	12	34	10.3
Total	**192 (57.8%)**	**140 (42.2%)**	**332**	**100**

Severity of Anemia

Moderate anemia was the most commonly encountered grade in the present study, observed in 162 patients (48.8%), followed by mild anemia in 119 patients (35.8%) and severe anemia in 51 patients (15.4%). Severe anemia was more prevalent in the oldest age group (>80 years) and among female patients.

Table 2: Severity of Anemia in Study Participants

Grade of Anemia (Hb, g/dL)	Females (n)	males (n)	Total (%)
Mild (Hb 10–13/12 g/dL)	67	52	119 (35.8%)
Moderate (Hb 7–10 g/dL)	92	70	162 (48.8%)
Severe (Hb <7 g/dL)	33	18	51 (15.4%)

Total	**192**	**140**	**332 (100%)**

Morphological Classification

Peripheral blood smear examination and MCV-based classification revealed that normocytic normochromic anemia (NCNC) was the predominant morphological type, observed in 148 patients (44.6%). Microcytic hypochromic anemia (MCHC) was identified in 126 patients (37.9%), while macrocytic anemia was observed in 58 patients (17.5%). This pattern is consistent with the predominance of anemia of chronic disease and iron deficiency anemia in the geriatric population, as documented in major Indian and international studies [10].

Table 3: Morphological Classification of Anemia

Morphological Type	Number (n)	Percentage (%)
Normocytic Normochromic (MCV 80–100 fL)	148	44.6%
Microcytic Hypochromic (MCV <80 fL)	126	37.9%
Macrocytic (MCV >100 fL)	58	17.5%
Total	**332**	**100%**

Etiological Profile

Anemia of chronic disease (ACD) was the most common etiology, identified in 112 patients (33.7%), followed by iron deficiency anemia (IDA) in 98 patients (29.5%), chronic kidney disease-related anemia in 44 patients (13.3%), megaloblastic anemia (due to vitamin B12 and/or folate deficiency) in 38 patients (11.4%), hematological malignancies and myelodysplastic syndrome in 22 patients (6.6%), and unexplained/multifactorial anemia in the remaining 18 patients (5.5%). Multifactorial etiologies, where more than one cause co-existed, were observed in a subset of cases, consistent with the biological complexity of geriatric anemia [11].

Table 4: Etiological Distribution of Anemia

Etiology	Number (n)	Percentage (%)
Anemia of Chronic Disease (ACD)	112	33.7%
Iron Deficiency Anemia (IDA)	98	29.5%
Chronic Kidney Disease (CKD)	44	13.3%
Megaloblastic Anemia (B12 / Folate deficiency)	38	11.4%
Hematological Malignancy / MDS	22	6.6%
Unexplained / Multifactorial	18	5.5%
Total	**332**	**100%**

Clinical Presentation

Generalized weakness was the most frequent presenting symptom, observed in 284 patients (85.5%). This was followed by fatigue and easy fatigability in 261 patients (78.6%), exertional dyspnea in 198 patients (59.6%), palpitations in 155 patients (46.7%), pedal edema in 89 patients (26.8%), dizziness in 72 patients (21.7%), and pallor detected on physical examination in 318 patients (95.8%). Notably, 19 patients (5.7%) were asymptomatic at presentation, with anemia discovered incidentally during routine blood work.

Comorbid Conditions

A significant proportion of patients presented with comorbid conditions. Hypertension was the most prevalent comorbidity, seen in 198 patients (59.6%), followed by type 2 diabetes mellitus in 176 patients (53.0%), chronic kidney disease in 44 patients (13.3%), cardiac disease in 62 patients (18.7%), malignancy in 22 patients (6.6%), hypothyroidism in 18 patients (5.4%), and chronic liver disease in 14 patients (4.2%). Multiple comorbidities were present in 68.4% of patients.

DISCUSSION

Anemia in the elderly is a multifaceted clinical syndrome

with complex pathophysiology, and the findings of this study reinforce the need for systematic evaluation even in the presence of mild anemia.

The predominance of female patients in this study (57.8%) contradict with findings from studies conducted by Krishnamurthy et al. (2022) and the clinico-pathological study by Mehta et al. (2021) from India, which reported higher rates of geriatric anemia in males [9, 10]. This sex disparity likely reflects the higher prevalence of comorbid conditions including chronic kidney disease, cardiovascular disease, and malignancy in elderly males, all of which are independently associated with anemia. Notably, a study by Joosten et al. found that anemia prevalence was significantly higher among elderly men (61%) compared to women (27%) in an acute geriatric ward [13].

The observation that moderate anemia constituted the largest severity group (48.8%) contrasts with studies from Western populations, where mild anemia predominates. This difference may reflect delayed healthcare-seeking behavior, limited access to preventive care, and higher burden of nutritional deficiency in the Indian elderly population. In the North Indian study by Khadwal et al., the mean hemoglobin value was 8.8 ± 2.3 g/dL, consistent with a predominantly moderate severity spectrum [7].

The morphological preponderance of normocytic normochromic anemia (44.6%) in this study is a well-established finding across tertiary care geriatric cohorts and reflects the predominance of anemia of chronic disease (ACD) as the leading etiology. Mehta et al. similarly reported normocytic normochromic anemia as the most common morphological type in a large clinico-pathological study involving 1,257 geriatric patients [10]. ACD in the elderly is driven by cytokine-mediated suppression of erythropoiesis, hepcidin-mediated iron sequestration, and reduced erythropoietin synthesis — mechanisms that converge in the context of chronic inflammatory states, infections, and malignancies [6].

Iron deficiency anemia (IDA), the second most common etiology (29.5%), is predominantly attributable to chronic gastrointestinal blood loss in the geriatric population. Upper gastrointestinal sources including peptic ulcer disease, gastritis, and esophagitis have been reported to account for over 50% of IDA cases in the elderly, while malignancy must always be excluded in new-onset iron deficiency anemia in this age group [7]. The relatively high prevalence of megaloblastic anemia (11.4%) in this cohort mirrors the high burden of dietary deficiencies of vitamin B12 and folate in the South Indian elderly population, where vegetarian dietary patterns and gastric atrophy that in turn leads to impaired intrinsic factor secretion which are common predisposing factors.

The high prevalence of multiple comorbidities observed in this study (68.4% of patients had more than one comorbid condition) is a defining feature of geriatric anemia. Anemia both exacerbates and is exacerbated by chronic conditions including diabetes, hypertension, chronic kidney disease, and cardiovascular disease. It has been demonstrated that anemia is significantly associated with a higher incidence of cardiovascular disease, cognitive impairment, reduced physical performance, and an increased risk of falls and fractures in the elderly [8,9]. Furthermore, Wang et al. (2023) demonstrated that anemia, particularly in combination with elevated systemic inflammation (elevated CRP), significantly increases the risk of dementia in older adults, a finding with important implications for comprehensive geriatric assessment [14].

These findings compel clinicians to treat mild anemia as a clinically significant entity requiring etiological investigation rather than a benign comorbidity of aging.

Despite advances in diagnostic methodologies, geriatric anemia remains chronically underdiagnosed and undertreated in routine clinical practice. A multicenter Italian study by Soraci et al. (2024) found that diagnostic inertia — defined as the failure to assess iron, vitamin B12, and folate status — was present in 22–31% of anemic elderly hospitalized patients, while replacement inertia (failure to initiate appropriate supplementation) affected 50–87% of eligible patients [12]. These statistics underscore the need for institutional protocols that mandate systematic etiological workup and treatment initiation for all elderly patients diagnosed with anemia.

CONCLUSION

Anemia is a highly prevalent and clinically consequential syndrome in the geriatric population, with significant implications for morbidity, functional status, cognitive health, and mortality. This prospective observational study at a South Indian tertiary care centre confirms that moderate-grade normocytic normochromic anemia secondary to anemia of chronic disease is the predominant pattern in the elderly, while iron deficiency and megaloblastic anemia account for a substantial proportion of cases.

The high prevalence of multimorbidity underscores the need for a holistic geriatric assessment approach that incorporates systematic hematological evaluation as a routine component. Even mild anemia should prompt etiological investigation rather than being dismissed as an age-related phenomenon.

RECOMMENDATION

Raising clinical awareness about geriatric anemia among general practitioners, internists, and geriatricians is imperative. Early identification, thorough etiological workup, and prompt institution of appropriate therapy have the potential to substantially improve functional outcomes, reduce hospitalization rates, and enhance the quality of life in elderly patients. Future longitudinal and population-based studies are warranted to ascertain the long-term consequences of anemia and the impact of therapeutic interventions in the Indian geriatric population.

REFERENCES

World Health Organization. *Guideline on Haemoglobin Cutoffs to Define Anaemia in Individuals and Populations*.

Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO. ISBN: 978-92-4-008854-2.

Wacka E, Nicikowski J, Jarmuzek P, Zembron-Lacny A. Anemia and its connections to inflammation in older adults: a review. *Journal of Clinical Medicine*. 2024;13(7):2049. doi:10.3390/jcm13072049.

Stauder R, Valent P, Theurl I. Anemia at older age: etiologies, clinical implications, and management. *Blood*. 2018;131(5):505–514. doi:10.1182/blood-2017-07-746446.

Joosten E, Detroyer E, Milisen K. Effect of anaemia on hand grip strength, walking speed, functionality and 1-year mortality in older hospitalized patients. *BMC Geriatrics*. 2016;16:153. doi:10.1186/s12877-016-0326-y.

Girelli D, Ugolini S, Busti F, Marchi G, Castagna A. Anemia in the elderly. *HemaSphere*. 2018;2(3):e40. doi:10.1097/HS9.0000000000000040.

Guralnik J, Ershler W, Artz A, Lazo-Langner A, Walston J, Pahor M, et al. Unexplained anemia of aging: etiology, health consequences, and diagnostic criteria. *Journal of the American Geriatrics Society*. 2022;70(3):891–899. doi:10.1111/jgs.17565.

Marzban M, Nabipour I, Farhadi A, Ostovar A, Larijani B, Darabi AH, et al. Association between anemia, physical performance and cognitive function in Iranian elderly people: evidence from Bushehr Elderly Health (BEH) program. *BMC Geriatrics*. 2021;21(1):329. doi:10.1186/s12877-021-02285-9.

Lee YJ, Kim HB. Association between anaemia and adult depression: a systematic review and meta-analysis of observational studies. *Journal of Epidemiology and Community Health*. 2020;74(7):565–572. doi:10.1136/jech-2020-213842.

Krishnamurthy S, Kumar B, Thangavelu S. Clinical and hematological evaluation of geriatric anemia. J Family Med Prim Care. 2022;11(6):3028–3033. doi:10.4103/jfmpc.jfmpc_2239_21

Mehta MU, Shah BA, Chetan DP. A clinico-pathological study of geriatric anemias. Hematol Transfus Cell Ther. 2021;43(3):284–291. doi:10.1016/j.htct.2020.06.012

Röhrig G, Becker I, Polidori MC, Schulz RJ, Noreik M. Association between anemia and frailty in German geriatric in-hospital patients. Z Gerontol Geriatr. 2015;48(2):107–112. doi:10.1007/s00391-014-0609-5

Soraci L, de Vincentis A, Aucella F, et al. Prevalence, risk factors, and treatment of anemia in hospitalized older patients across geriatric and nephrological settings in Italy. Sci Rep. 2024;14:19721. doi:10.1038/s41598-024-70644-8

Joosten E, Detroyer E, Milisen K. Effect of anaemia on hand grip strength, walking speed, mobility independence and fall risk in older hospitalized patients. BMC Geriatr. 2016;16:153. doi:10.1186/s12877-016-0326-y

Wang J, Wang C, Li X, et al. Association of anemia with cognitive function and dementia among older adults: the role of inflammation. J Alzheimers Dis. 2023;96(1):125–134. doi:10.3233/JAD-230483.