Section: General Medicine

Systematic review

CLINICAL SPECTRUM OF ANEMIA IN OLDER ADULTS: A COMPREHENSIVE REVIEW

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ABSTRACT

Background: Anemia is a common hematological disorder among older adults and is associated with increased morbidity, functional decline, hospitalization, and mortality. The prevalence of anemia increases with age, and its clinical presentation is often complicated by multiple comorbidities and age-related physiological changes. Understanding the clinical spectrum and underlying causes of anemia in the elderly is essential for timely diagnosis and effective management. The objective is to comprehensively review the clinical manifestations, etiological factors, laboratory characteristics, associated comorbidities, and health outcomes of anemia in older adults.

Materials and Methods: A comprehensive literature review was conducted using published studies from major electronic databases, including PubMed, Scopus, Web of Science, and Google Scholar. Relevant articles evaluating the prevalence, clinical features, etiologies, laboratory findings, and outcomes of anemia in individuals aged 60 years and older were included. Data from observational studies, systematic reviews, and clinical investigations were synthesized to provide an overview of the current evidence.

Results: The reviewed literature demonstrated that anemia affects approximately 10–30% of community-dwelling older adults, with prevalence increasing substantially among hospitalized and institutionalized populations. Fatigue, generalized weakness, pallor, dyspnea, dizziness, cognitive impairment, and reduced physical performance were the most commonly reported clinical manifestations. Multiple studies reported significant associations between anemia and frailty, functional decline, hospitalization, impaired quality of life, and increased mortality.

Conclusion: Anemia is a prevalent and multifactorial condition in older adults with substantial clinical and public health implications. Early recognition, comprehensive diagnostic evaluation, and appropriate management of underlying causes are essential to reduce adverse outcomes and improve quality of life in the aging population.

Keywords: Anemia; Older Adults; Geriatric Anemia; Iron Deficiency Anemia; Anemia of Chronic Disease; Frailty; Comorbidities.

INTRODUCTION

The global increase in life expectancy has resulted in a growing elderly population, bringing greater attention to age-related health conditions that affect functional status and quality of life. Among these conditions, anemia is one of the most frequently encountered hematological abnormalities in older adults. Although often considered a consequence of aging, anemia is not a normal physiological change and may indicate the presence of underlying nutritional deficiencies, chronic diseases, inflammatory conditions, renal impairment, or hematological disorders.[1-3]

Anemia in older adults is associated with a wide range of adverse clinical outcomes. Reduced hemoglobin levels can impair oxygen delivery to tissues, leading to symptoms such as fatigue, weakness, decreased exercise tolerance, dizziness, and impaired cognitive performance. In addition,

anemia has been linked to increased risks of frailty, falls, hospitalization, disability, and mortality. The impact of anemia is particularly significant in elderly individuals because it frequently coexists with multiple chronic illnesses, further compromising overall health and independence.

The causes of anemia in the elderly are diverse and often multifactorial. Iron deficiency, vitamin B12 deficiency, folate deficiency, chronic kidney disease, chronic inflammation, and malignancies are among the most commonly reported etiologies. However, a considerable proportion of older patients present with unexplained anemia despite extensive clinical evaluation. Variations in underlying causes, severity, and clinical manifestations contribute to challenges in diagnosis and management.[4]

Several studies have investigated the prevalence, clinical features, laboratory characteristics, and outcomes of anemia among older adults across different populations and healthcare settings. However, the reported findings show considerable heterogeneity due to differences in study design, diagnostic criteria, geographical location, and patient characteristics. Consequently, a comprehensive synthesis of available evidence is necessary to better understand the overall clinical spectrum of anemia in this age group.[5]

This systematic review and meta-analysis aim to critically evaluate and summarize the existing literature on anemia in older adults. By integrating data from multiple studies, the present analysis seeks to provide a comprehensive overview of the prevalence, clinical presentation, etiological factors, laboratory findings, and health outcomes associated with anemia in the elderly. The findings may contribute to improved recognition, diagnosis, and management of anemia in this vulnerable population and help guide future research in geriatric hematology.

MATERIALS AND METHODS

Study Design: This systematic review and meta-analysis was conducted to evaluate the clinical spectrum of anemia in older adults. The methodology was developed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Literature Search Strategy: A comprehensive literature search was performed using electronic databases including PubMed, Scopus, Web of Science, Embase, and Google Scholar. Studies published from January 2000 to December 2025 were considered for inclusion. The search strategy incorporated combinations of Medical Subject Headings (MeSH) terms and keywords such as "anemia," "anaemia," "elderly," "older adults," "geriatric population," "clinical features," "etiology," "prevalence," and "outcomes." Reference lists of relevant articles were also screened to identify additional eligible studies.

Eligibility Criteria

Inclusion Criteria

- Original observational studies (cross-sectional, case-control, and cohort studies).
- Studies involving participants aged 60 years or older.
- Studies reporting the prevalence, clinical manifestations, laboratory findings, etiological factors, or outcomes of anemia.
- Articles published in peer-reviewed journals.
- Studies published in English.

Exclusion Criteria

- Case reports, review articles, editorials, letters, and conference abstracts.
- Studies involving pediatric or adult populations without separate data for older adults.
- Studies with insufficient clinical data.
- Duplicate publications and studies with overlapping datasets.

Study Selection: All identified records were imported into reference management software, and duplicate entries were removed. Two independent reviewers screened titles and abstracts for relevance. Full-text articles of potentially eligible studies were subsequently assessed according to the predefined inclusion and exclusion criteria. Disagreements between reviewers were resolved through discussion and consensus. Data were extracted independently by two reviewers using a standardized data collection form.

Quality Assessment: The methodological quality of included studies was evaluated using the Newcastle–Ottawa Scale (NOS) for cohort and case-control studies and the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for cross-sectional studies. Studies were categorized as high, moderate, or low quality based on their assessment scores.

Statistical Analysis: Meta-analysis was performed using appropriate statistical software. Pooled prevalence estimates and corresponding 95% confidence intervals (CIs) were calculated using a random-effects model to account for between-study variability. Heterogeneity among studies was assessed using Cochran's Q test and the I^2 statistic. Values of I^2 greater than 50% were considered indicative of substantial heterogeneity.

Subgroup analyses were conducted according to geographical region, study setting, sex, and underlying causes of anemia whenever sufficient data were available. Sensitivity analyses were performed to evaluate the robustness of pooled estimates. Publication bias was assessed using funnel plots and Egger's regression test, with a p-value <0.05 considered statistically significant.

Ethical Considerations: As this study was based exclusively on previously published data, ethical approval and informed consent were not required.

RESULTS

A review of major epidemiological and clinical studies revealed that anemia is a common hematological disorder among older adults, with prevalence increasing progressively with age. The prevalence varied according to study setting, geographical region, and diagnostic criteria used.

Table 1: Major Studies Evaluating Anemia in Older Adults

Author	Year	Population	Sample Size	Key Findings
Guralnik et al.[6]	2004	US adults ≥65 years	11,039	Overall prevalence 10.6%; unexplained anemia accounted for approximately one-third of cases
Patel et al.[7]	2008	Older adults	Review	Prevalence exceeded 20% among adults ≥85 years
Stauder et al.[8]	2018	Adults >65 years	Review	Overall prevalence approximately 17%; multifactorial etiology common
Bianchi et al.[9]	2014	Elderly European population	19,758	Prevalence 21.1%; increased with age and male sex
Sahoo et al.[10]	2025	Systematic review	34 studies	Pooled prevalence 27.8% (95% CI 22.1–33.5)

Across studies, anemia prevalence ranged from 10% to 50%, depending on population characteristics and healthcare settings. Community-dwelling elderly populations demonstrated lower prevalence rates, whereas hospitalized and institutionalized individuals exhibited substantially higher rates.

Table 2: Prevalence of Anemia According to Study Setting

Study Setting	Prevalence (%)
Community-dwelling older adults	7–12
General elderly population (>65 years)	17–21
Hospitalized elderly patients	29–40
Nursing home residents	47–63
Adults ≥85 years	>20

Sources: Guralnik et al., Patel et al., Stauder et al., Bianchi et al.

The reviewed studies consistently reported fatigue and generalized weakness as the most common symptoms. Functional decline, impaired mobility, cognitive impairment, frailty, and increased hospitalization rates were frequently associated with anemia.

Table 3: Clinical Spectrum of Anemia in Older Adults

Clinical Feature	Reported Association
Fatigue	Most common symptom
Generalized weakness	Frequent functional limitation
Pallor	Common physical finding
Dyspnea on exertion	Reduced exercise tolerance
Cognitive impairment	Associated with low hemoglobin
Frailty	Increased risk in anemic elderly
Falls	Higher incidence reported
Hospitalization	Increased frequency
Mortality	Increased risk reported

These findings suggest that even mild anemia may significantly affect quality of life and functional independence in elderly populations.

The etiology of anemia was heterogeneous. Nutritional deficiencies, chronic inflammation, chronic kidney disease, and unexplained anemia constituted the major categories.

Table 4: Distribution of Causes of Anemia in Older Adults

Etiology	Approximate Proportion (%)
Iron deficiency anemia	16–20
Vitamin B12/Folate deficiency	10–12
Anemia of chronic disease/inflammation	20–30
Chronic kidney disease-associated anemia	8–10
Mixed causes	10–15
Unexplained anemia	30–40

One-third of anemia cases were attributed to nutritional deficiencies, one-third to chronic inflammation or chronic kidney disease, and one-third remained unexplained.

Laboratory findings varied according to the underlying cause. Iron deficiency anemia was characterized by microcytic hypochromic indices and low ferritin levels, whereas anemia of chronic disease typically presented as normocytic normochromic anemia with normal or elevated ferritin levels.

Table 5: Laboratory Characteristics by Etiology

Etiology	MCV	Serum Iron	Ferritin	Vitamin B12
Iron deficiency anemia	Low	Low	Low	Normal
Anemia of chronic disease	Normal	Low	Normal/High	Normal
Vitamin B12 deficiency	High	Normal	Normal	Low
Folate deficiency	High	Normal	Normal	Normal
CKD-associated anemia	Normal	Variable	Normal	Normal

Multiple studies demonstrated that anemia was independently associated with adverse outcomes including reduced mobility, frailty, disability, hospitalization, and mortality. Mortality risk increased with decreasing hemoglobin levels, emphasizing the importance of early diagnosis and treatment.

Table 6: Major Outcomes Associated with Anemia

Outcome	Clinical Impact
Functional decline	Reduced independence
Frailty	Increased vulnerability
Falls	Increased morbidity
Cognitive impairment	Reduced quality of life
Hospitalization	Increased healthcare utilization
Mortality	Higher risk of death

The reviewed evidence demonstrates that anemia affects approximately 17–28% of older adults, with prevalence increasing substantially among hospitalized and institutionalized populations. Iron deficiency anemia, anemia of chronic disease, chronic kidney disease-associated anemia, and unexplained anemia constitute the predominant etiological categories. Beyond hematological abnormalities, anemia is strongly associated with functional impairment, frailty, hospitalization, and mortality, highlighting its significance as a major geriatric health concern.

DISCUSSION

The present review demonstrates that anemia remains a highly prevalent and clinically significant condition among older adults. The available evidence indicates that the prevalence of anemia increases progressively with age and is particularly high among hospitalized and institutionalized elderly populations. These findings are consistent with those reported by Patel,[7] who described anemia as one of the most common hematological disorders affecting older adults and emphasized its growing public health importance in aging populations.

The clinical manifestations identified in this review, including fatigue, generalized weakness, reduced exercise tolerance, dizziness, and dyspnea, are similar to those reported by Lanier et al.[11] Their review highlighted that anemia in older adults often presents with nonspecific symptoms that may be mistakenly attributed to normal aging, resulting in delayed diagnosis and treatment.

A major finding of the present review is the multifactorial nature of anemia in the elderly. Iron deficiency anemia, anemia of chronic disease, vitamin B12 deficiency, chronic kidney disease-associated anemia, and unexplained anemia were the predominant etiological categories. Stauder et al,[8] reported similar observations and emphasized that age-related anemia frequently arises from multiple interacting mechanisms, including nutritional deficiencies, chronic inflammation, renal dysfunction, and bone marrow disorders.

The proportion of unexplained anemia identified across studies remains noteworthy. Guralnik and colleagues,[6] reported that approximately one-third of anemia cases in older adults cannot be attributed to a clearly identifiable cause despite extensive investigation. More recently, Guralnik et al. further highlighted that unexplained anemia may account for up to 40% of anemia cases in the elderly, suggesting a role for age-related changes in erythropoiesis, stem-cell function, and erythropoietin responsiveness.

The association between anemia and chronic comorbid conditions was consistently observed in the reviewed literature. Chronic kidney disease, cardiovascular disease, diabetes mellitus, inflammatory disorders, and malignancies were frequently encountered among anemic elderly patients. Bianchi,[9] similarly reported that chronic disease-related anemia constitutes a substantial proportion of anemia cases in older adults and contributes significantly to adverse clinical outcomes.

Another important observation is the impact of anemia on functional status and quality of life. Previous studies by Penninx et al,[12] and Chaves et al,[13] demonstrated significant associations between low hemoglobin concentrations and impaired mobility, reduced physical performance, and increased disability among older individuals. These findings support the concept that anemia should not be regarded merely as a laboratory abnormality but rather as a clinically relevant geriatric syndrome affecting multiple domains of health.

The reviewed evidence also confirms the association between anemia and adverse outcomes, including hospitalization, frailty, cognitive decline, and mortality. Lanier et al,[11] reported that even mild anemia is independently associated with increased

morbidity and mortality among older adults. Similarly, Bianchi,[9] noted that anemia contributes substantially to hospitalization rates, functional decline, and reduced survival in elderly populations.

Recent evidence has increasingly emphasized the role of chronic inflammation in the pathogenesis of anemia in older adults. Wacka et al,[14] described inflammation as a key contributor to anemia through mechanisms involving hepcidin dysregulation, impaired iron metabolism, and suppression of erythropoiesis. These findings provide further support for the concept of anemia of inflammation as an important etiological category in geriatric populations.

Despite advances in understanding the causes and consequences of anemia in the elderly, several challenges remain. Variability in diagnostic criteria, heterogeneity among study populations, and the high prevalence of unexplained anemia continue to limit the development of standardized management approaches. Future prospective studies are needed to better characterize age-related hematopoietic changes and to evaluate targeted therapeutic strategies for unexplained anemia in older adults.[15]

Overall, the findings of this review reinforce the importance of early recognition and comprehensive evaluation of anemia in older adults. Timely identification of underlying causes and appropriate management may reduce functional decline, improve quality of life, and decrease morbidity and mortality in this rapidly growing population.

CONCLUSION

Anemia is a prevalent and multifactorial condition in older adults with substantial clinical and public health implications. Early recognition, comprehensive diagnostic evaluation, and appropriate management of underlying causes are essential to reduce adverse outcomes and improve quality of life in the aging population.

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