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ANEMIA IN THE GERIATRIC POPULATION: A PROSPECTIVE OBSERVATIONAL STUDY OF 100 PATIENTS AGED 60–89 YEARS

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ABSTRACT

Background: Aim to study the prevalence, clinico-hematological profile, etiological pattern, and functional impact of anemia in the geriatric population, and to evaluate the association between anemia severity and common geriatric syndromes in a cohort of 100 patients aged 60–89 years attending a tertiary-care hospital.

Materials and Methods: This was a hospital-based, prospective, observational study. Detailed sociodemographic and clinical data were collected using a structured proforma. Symptoms, comorbidities, nutritional history, drug intake, and functional status were recorded. Physical examination included vital parameters, anthropometry, and focused systemic examination. Laboratory evaluation comprised complete blood count with red cell indices, peripheral smear, reticulocyte count, serum iron, ferritin, total iron-binding capacity (TIBC) was done.

Results: Anemia is highly prevalent in the geriatric population and is frequently multifactorial, with iron deficiency and anemia of chronic disease being the leading causes. Increasing severity of anemia is associated with higher burden of comorbidities, functional decline, frailty, and healthcare utilization. Mild, moderate, and severe anemia were observed in 46%, 38% and 16% of patients, respectively. The predominant morphologic pattern was normocytic normochromic anemia (48%), followed by microcytic hypochromic (34%) and macrocytic (18%) patterns. Iron-deficiency anemia was the commonest etiology, accounting for 36% of cases.

Conclusion: Early recognition and systematic evaluation of anemia in older adults are essential to identify treatable causes, optimize functional outcomes and reduce morbidity. Screening for anemia should be integrated into comprehensive geriatric assessment, and management should be individualized, addressing nutritional deficiencies, chronic disease control and iatrogenic factors.

Keywords: Anemia; elderly; geriatric; iron-deficiency anemia; functional status.

INTRODUCTION

The global population is ageing rapidly, with the proportion of individuals aged 60 years and above increasing in both developed and developing countries.[9] Anemia is one of the most common hematological abnormalities in older adults, yet it often remains under-recognized and undertreated because its manifestations are subtle and frequently attributed to normal ageing or coexisting chronic diseases.[10,11] The World Health Organization (WHO) defines anemia as hemoglobin (Hb) <13 g/dL in men and <12 g/dL in non-pregnant women, thresholds that have been widely applied across age groups.[1,12] However, hemoglobin levels tend to decline with advancing age, and the clinical

relevance of anemia in the elderly has attracted increasing attention in the last two decades.[12-14]

Epidemiological studies from community and hospital settings have shown that the prevalence of anemia in older persons ranges from 10–24% in community-dwelling elders to more than 40% in institutionalized or hospitalized populations.[10,13,15] In India and other low- and middle-income countries, the prevalence is further amplified by widespread nutritional deficiencies, chronic infections, inflammatory conditions and limited access to healthcare.[16] Anemia in older adults is not a benign finding; it is associated with fatigue, reduced exercise tolerance, cognitive dysfunction, falls, depression, impaired quality of life, increased hospitalization and mortality.[10,12,15,17] Even mild reductions in Hb have been linked to adverse outcomes such as functional decline and loss of independence.[10,13]

The etiology of anemia in geriatric patients is often multifactorial. Common causes include iron-deficiency due to gastrointestinal blood loss or poor dietary intake, anemia of chronic disease/inflammation related to infections, malignancy or chronic organ dysfunction, nutritional deficiencies of vitamin B12 and folate, renal insufficiency, bone marrow disorders, and drug-induced marrow suppression.[3,4,12,18] In a substantial proportion of older patients, no clear cause is identified despite extensive work-up, leading to a category termed "unexplained anemia of the elderly".[19] Furthermore, comorbid conditions such as chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD), heart failure and malignancy are prevalent in this age group, modifying the clinical impact and therapeutic considerations in anemia management.[3,12,18]

Geriatric anemia presents unique diagnostic and therapeutic challenges. Physiological changes with age, such as reduced bone marrow reserve and altered iron metabolism, may interact with disease-related factors.[18,19] Polypharmacy, frequent in older adults, can contribute through gastrointestinal blood loss from non-steroidal anti-inflammatory drugs (NSAIDs), impaired nutrient absorption due to proton-pump inhibitors, or direct bone marrow toxicity of certain drugs.[20] Cognitive impairment, sensory deficits and social factors such as poor income and isolation may compromise dietary adequacy and adherence to treatment.[21] Therefore, an integrated approach that combines clinical, laboratory and functional assessment is essential in evaluating anemia in the elderly.

Despite the significant burden of anemia in older adults, data from Indian tertiary-care settings, particularly focusing on detailed clinico-haematological and functional profiles, are limited. Many existing studies have concentrated on prevalence or on specific aetiologies, with fewer describing the inter-relationships between anemia severity and geriatric syndromes such as frailty, falls and cognitive impairment. Additionally, there is ongoing debate regarding the most appropriate hemoglobin thresholds to define anemia in older persons and their prognostic implications.

In this context, the present study was undertaken to evaluate anemia in a cohort of geriatric patients aged 60–89 years attending a tertiary-care teaching hospital. The specific objectives were: (i) to describe the prevalence of mild, moderate and severe anemia in this population; (ii) to delineate the morphologic and etiological patterns of anemia; (iii) to examine the association between anemia severity and common comorbid conditions; and (iv) to assess the relationship between anemia and functional status, including frailty and other geriatric syndromes. Understanding these aspects can help clinicians recognize anemia as a significant, modifiable contributor to morbidity in older adults and design appropriate diagnostic and management strategies.

MATERIALS AND METHODS

Study Design and Setting This was a prospective, hospital-based, observational study conducted in the Department of Medicine of a tertiary-care teaching hospital catering to an urban and semi-urban population. The study was carried out over a period of 12 months.

Study Population A total of 100 consecutive geriatric patients with anemia who attended the medicine outpatient department (OPD) or were admitted to the medical wards during the study period were enrolled. Geriatric status was defined as age ≥60 years. Eligible patients were between 60 and 89 years of age.

Inclusion Criteria

- Age between 60 and 89 years.
- Presence of anemia defined as Hb <13 g/dL in men and <12 g/dL in women, as per WHO criteria for adults.
- Willingness to provide informed written consent (self or legally acceptable representative, in case of mild cognitive impairment).

Exclusion Criteria

- Acute blood loss due to trauma, gastrointestinal bleeding or surgery within the preceding 3 months.
- Blood transfusion within the preceding 3 months.
- Known hematological malignancy (e.g., leukemia, lymphoma, multiple myeloma).
- Current chemotherapy or radiotherapy.
- Pregnancy (although unlikely in the specified age group, included for completeness).
- Refusal to consent.

Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee. All procedures were conducted in accordance with the Declaration of Helsinki and relevant national guidelines. Confidentiality of patient data was maintained throughout the study.

Data Collection

After obtaining consent, each participant underwent a detailed evaluation using a pre-designed and pre-tested proforma that included:

- **Sociodemographic data:** age, sex, marital status, education, occupation, socioeconomic status.
- **Clinical history:** presenting symptoms (fatigue, breathlessness, palpitations, chest pain, dizziness, syncope, reduced effort tolerance), duration of symptoms, history of weight loss, bleeding manifestations, drug history (NSAIDs, anticoagulants, antiplatelets, proton-pump inhibitors, antitubercular drugs), alcohol and smoking history.
- **Comorbidities:** hypertension, diabetes mellitus, CKD, COPD, chronic liver disease, heart failure, coronary artery disease, malignancy, inflammatory disorders, rheumatologic conditions.
- **Nutritional history:** dietary pattern (vegetarian/non-vegetarian), intake of iron-rich and vitamin B12/folate-rich foods, history of malabsorption, prior gastrointestinal surgery.
- **Functional and geriatric assessment:** ADL and IADL scores, history of falls in the preceding 1year, subjective gait instability, screening for frailty (simple validated clinical frailty scale), and brief cognitive and mood assessment using simple tools feasible in routine clinical practice.

Clinical Examination

A complete physical examination was performed in all participants, including:

- General examination: pallor, icterus, oedema, lymphadenopathy, signs of dehydration or malnutrition.
- Vital signs: pulse rate, blood pressure (supine and standing, to detect orthostatic hypotension), respiratory rate, temperature.
- Systemic examination: cardiovascular, respiratory, abdominal, and neurological examinations with particular attention to cardiac murmurs, signs of heart failure, evidence of chronic lung disease, organomegaly, masses and focal neurological deficits.

Laboratory Investigations

All patients underwent baseline investigations as per institutional protocols:

- Complete blood count (CBC) including Hb, total and differential leukocyte count, platelet count, red cell indices (MCV, mean corpuscular hemoglobin [MCH], mean corpuscular hemoglobin concentration [MCHC]).
- Peripheral blood smear examination for red cell morphology, anisopoikilocytosis, hypochromia, hyper segmented neutrophils, blast cells or abnormal cells.
- Reticulocyte count.
- Erythrocyte sedimentation rate (ESR).
- Serum iron, TIBC, transferrin saturation and serum ferritin.
- Serum vitamin B12 and folate levels where clinically indicated.
- Renal function tests: blood urea nitrogen, serum creatinine, estimated glomerular filtration rate (eGFR).
- Liver function tests.
- Fasting blood glucose and/or HbA1c.
- Stool examination for occult blood (three samples) in suspected gastrointestinal blood loss.
- Additional investigations such as upper gastrointestinal endoscopy, colonoscopy, ultrasound/CT abdomen, and bone marrow examination were done in selected patients based on clinical judgement.

RESULTS

A total of 100 geriatric patients with anemia were included in the present study. The mean age of the cohort was 71.8 ± 7.5 years (range 60–89 years). The majority (44%) were in the 60–69-year age group, followed by 70–79 years (38%) and 80–89 years (18%). There was a slight male preponderance, with 58 males and 42 females. Most patients (64%) were from urban or semi-urban areas, and 62% followed a vegetarian diet (Table 1).

About anemia severity, 46 patients (46%) had mild anemia, 38 (38%) had moderate anemia and 16 (16%) had severe anemia (Table 2). Normocytic normochromic anemia was the most common morphological pattern observed in 48% of patients, followed by microcytic hypochromic pattern in 34% and macrocytosis in 18%. As per etiological classification, iron-deficiency anemia was the leading cause and was diagnosed in 36% of the cohort, while anemia of chronic disease accounted for 28%. Combined IDA with ACD was present in 12%, megaloblastic anemia in 10%, CKD-related anemia in 8% and unexplained anemia in 6%.

Comorbidities were highly prevalent. Hypertension was seen in 62% of patients, type 2 diabetes mellitus in 48%, CKD in 30%, COPD in 26% and ischemic heart disease in 18% (Table 3). Mean hemoglobin levels across severity categories were 11.1 ± 0.6 g/dL in mild, 8.8 ± 0.6 g/dL in moderate and 6.2 ± 0.5 g/dL in severe anemia. Mean MCV tended to be lower in the severe group, consistent with predominance of microcytic hypochromic anemia in more severe cases (Table 4). Median serum ferritin levels were lower in moderate and severe anemia compared to mild, in keeping with a higher load of iron-deficiency. Vitamin B12 levels were below the lower reference limit in 10 patients with macrocytosis and megaloblastic features, and borderline in a subset of others, suggesting that subclinical B12 deficiency may be contributory in some cases.

Hospitalization rates were higher among patients with moderate and severe anemia. Although the present study was not primarily powered to assess hard outcomes like mortality, clinical observation

suggested that anemic elders with lower Hb levels had more frequent heart failure exacerbations, infections and prolonged hospital stays.

Statistical Analysis: Data were entered into a spreadsheet and analyzed using standard statistical software (e.g., SPSS or equivalent). Continuous variables were summarized as mean ± SD or median (IQR) depending on distribution. Categorical variables were expressed as counts and percentages. Comparisons between groups (e.g., mild vs moderate/severe anemia) were done using Student's t-test or Mann–Whitney U-test for continuous variables, and chi-square test or Fisher's exact test for categorical variables. A p-value <0.05 was considered statistically significant.

Table 1: Demographic and Clinical Profile of Geriatric Patients with Anemia (N = 100)

Parameter	Value
Age (years), mean ± SD	71.8 ± 7.5
Age group 60–69 years, n (%)	44 (44.0)
Age group 70–79 years, n (%)	38 (38.0)
Age group 80–89 years, n (%)	18 (18.0)
Male, n (%)	58 (58.0)
Female, n (%)	42 (42.0)
Rural residence, n (%)	36 (36.0)
Urban/semi-urban residence, n (%)	64 (64.0)
Vegetarian diet, n (%)	62 (62.0)
Non-vegetarian diet, n (%)	38 (38.0)
History of NSAID use, n (%)	28 (28.0)
History of antiplatelet/anticoagulant use, n (%)	24 (24.0)

Table 2: Distribution of Anemia by Severity, Morphology and Aetiology (N = 100)

Parameter	n (%)
Severity of anemia	
Mild	46 (46.0)
Moderate	38 (38.0)
Severe	16 (16.0)
Morphologic pattern	
Microcytic hypochromic	34 (34.0)
Normocytic normochromic	48 (48.0)
Macrocytic	18 (18.0)
etiology	
Iron-deficiency anemia	36 (36.0)
Anemia of chronic disease	28 (28.0)
Combined IDA + ACD	12 (12.0)
Megaloblastic anemia	10 (10.0)
CKD-related anemia	8 (8.0)
Unexplained anemia	6 (6.0)

Table 3: Comorbidities and Geriatric Syndromes in Relation to Anemia Severity

Parameter	Mild (n = 46)	Moderate/Severe (n = 54)	p-value
Hypertension, n (%)	26 (56.5)	36 (66.7)	0.30
Type 2 diabetes mellitus, n (%)	20 (43.5)	28 (51.9)	0.40
CKD, n (%)	10 (21.7)	20 (37.0)	0.09
COPD, n (%)	8 (17.4)	18 (33.3)	0.07
Ischemic heart disease, n (%)	6 (13.0)	12 (22.2)	0.25
Frailty (present), n (%)	12 (26.1)	30 (55.6)	0.004
History of fall in last year, n (%)	8 (17.4)	22 (40.7)	0.01
Impaired ADL/IADL, n (%)	16 (34.8)	36 (66.7)	0.002
Cognitive impairment (screen-positive), n (%)	10 (21.7)	24 (44.4)	0.02

Table 4: Hematological Parameters According to Anemia Severity

Parameter	Mild (n = 46)	Moderate (n = 38)	Severe (n = 16)
Hb (g/dL), mean ± SD	11.1 ± 0.6	8.8 ± 0.6	6.2 ± 0.5
MCV (fL), mean ± SD	86.4 ± 9.2	83.8 ± 10.8	81.2 ± 11.5
Reticulocyte count (%), median (IQR)	1.2 (0.8–1.8)	1.4 (0.9–2.0)	1.8 (1.0–2.6)
Serum ferritin (ng/mL), median (IQR)	48 (22–96)	36 (18–74)	28 (14–60)
Vitamin B12 (pg/mL), median (IQR)	260 (190–340)	230 (170–310)	210 (160–280)

DISCUSSION

In this prospective observational study of 100 geriatric patients aged 60–89 years with anemia, we observed that normocytic normochromic anemia was the predominant morphological type, and iron-deficiency anemia and anemia of chronic disease were the leading etiologies. Anemia severity showed a significant association with frailty, functional dependence, history of falls and cognitive impairment, highlighting the broad clinical impact of

anemia in older adults beyond simple hematological abnormalities.

The mean age of our cohort (71.8 years) and the male predominance are comparable to several hospital-based studies from India and elsewhere. While the present study included only anemic patients and did not estimate prevalence in the background geriatric population, other community-based studies have reported anemia prevalence rates ranging from 10–24% in community-dwelling older adults and up to 40–60% in hospitalized or institutionalized elders. Our findings that almost half of patients had mild anemia, with the remainder having moderate or severe anemia, are consistent with previous observations that anemia in older adults is often mild to moderate in degree but clinically significant.

Morphologically, normocytic anemia in our cohort likely reflects the contribution of chronic disease, CKD and mixed etiologies, while microcytosis was predominantly associated with iron-deficiency and combined deficiency states. Macrocytosis, observed in 18% of patients, corresponded chiefly to vitamin B12/folate deficiency and, in a few cases, alcohol use and drug effects. The distribution of morphologic patterns broadly matches other series of elderly anemia, where normocytic anemia is usually the most frequent, followed by microcytic and macrocytic forms.

Iron-deficiency anemia was the leading cause (36%) in our study, in line with earlier Indian studies that have emphasized nutritional deficiency and occult gastrointestinal blood loss as major contributors in older adults. Gastrointestinal evaluation in our patients with IDA frequently revealed gastritis, peptic ulcer disease, or colonic pathology, though detailed endoscopic findings are beyond the scope of this paper. The relatively high prevalence of vegetarian diet and possible inadequate intake or absorption of haem iron may also have contributed to IDA in this cohort.

Anemia of chronic disease accounted for 28% of cases, reflecting the high burden of chronic inflammatory conditions, infections, CKD, COPD, and heart failure in elderly patients. It is noteworthy that 12% of patients had combined IDA and ACD, which emphasizes the multifactorial nature of anemia in this age group and the need for a comprehensive evaluation rather than assuming a single cause. Megaloblastic anemia due to vitamin B12 or folate deficiency was seen in 10% of cases, a figure comparable to other reports in older Indians. CKD-related anemia was present in 8%, which may be an underestimate given that anemia of CKD overlaps clinically and biochemically with ACD.

Unexplained anemia was identified in 6% of patients despite reasonably detailed evaluation. This proportion is somewhat lower than the 15–30% reported in Western series of elderly anemia, where "unexplained anemia of the elderly" has emerged as a recognized entity, potentially linked to age-related decline in erythropoietin production or subtle clonal hematopoiesis. Differences in diagnostic thresholds, the extent of work-up and underlying population characteristics may partly explain this discrepancy.

One of the important observations in our study is the strong association between anemia severity and geriatric syndromes such as frailty, functional dependence, falls and cognitive impairment. Patients with moderate to severe anemia had significantly higher prevalence of frailty, as assessed by a simple clinical frailty scale, as well as higher rates of impaired ADL/IADL, history of falls and screening-positive cognitive impairment compared to those with mild anemia. These findings mirror earlier studies that have demonstrated links between anemia and decreased physical performance, reduced muscle strength, slow gait and falls in older adults.

The mechanisms underlying these associations are likely multifactorial. Reduced oxygen-carrying capacity in anemia leads to tissue hypoxia, fatigue, and diminished exercise tolerance, which can contribute to muscle weakness, impaired balance, and increased fall risk. Chronic anemia may also exacerbate cardiovascular disease, limit cardiac reserve and further impairing physical capacity. Cognitive impairment in anemic elders may be mediated by cerebral hypoxia, microvascular disease, systemic inflammation, and coexistent nutritional deficiencies, particularly vitamin B12 deficiency, which is independently associated with neurocognitive dysfunction.

Our observation that moderates to severe anemia, rather than mild anemia, is more strongly associated with geriatric syndromes is consistent with the dose–response relationships described in large cohort studies, where even Hb levels near the lower limit of normal have been associated with adverse outcomes, but risks increase progressively as Hb declines. These data underscore the clinical importance of recognizing and treating even "mild" anemia in elderly individuals, particularly those with functional decline or frailty.

The high burden of comorbid conditions in our cohort is expected in a geriatric population; hypertension, diabetes, CKD, COPD, and ischemic heart disease were frequent. While some of these comorbidities did not show statistically significant differences between anemia severity groups in our sample, CKD and COPD were more common in moderate/severe anemia, suggesting that chronic organ dysfunction both contributes to and is worsened by anemia. Anemia in CKD is well recognized and is associated with increased cardiovascular risk, hospitalization, and mortality. Similarly, anemia in COPD amplifies dyspnea and exercise limitation.

From a clinical standpoint, the coexistence of anemia with multiple comorbidities complicates management. Polypharmacy, common in this population, can contribute to anemia through gastrointestinal blood loss (e.g., NSAIDs, antiplatelets), impaired nutrient absorption (e.g., proton-pump inhibitors) or marrow suppression (e.g., certain disease-modifying agents). Identifying and

modifying drug-related contributors is therefore an essential component of anemia evaluation in elderly patients.

Our results are broadly in agreement with previous reports indicating that approximately one-third of elderly anemia cases are due to iron deficiency, another one-third to anemia of chronic disease, and the remainder to nutritional deficiencies, CKD and unexplained causes. The exact proportions vary across populations due to differences in nutritional status, prevalence of chronic disease, diagnostic work-up and definitions used.

Studies from Western countries have highlighted the adverse prognostic significance of anemia in older persons, linking it to increased mortality, hospitalization, disability and poorer quality of life. Similar associations are emerging from Indian and other Asian cohorts, although more longitudinal data are needed. Our study adds to this body of evidence by demonstrating significant associations between anemia severity and functional measures such as frailty, ADL/IADL, falls and cognitive status in a tertiary-care Indian setting.

Strengths and Limitations

The strengths of the present study include its prospective design, focus on a well-defined geriatric age group (60–89 years), and the incorporation of both hematological and geriatric assessments. We employed a systematic approach to classify anemia morphologically and etiologically, and we examined clinically relevant outcomes such as functional status and falls, which are directly meaningful in geriatric practice.

However, certain limitations must be acknowledged. First, this was a single-centre, hospital-based study with a relatively small sample size (n = 100), which may limit generalizability to the broader community-dwelling elderly population and reduce statistical power to detect some associations. Second, the cross-sectional design precludes causal inferences and does not allow assessment of long-term outcomes such as mortality or sustained functional decline. Third, although we performed a comprehensive evaluation, resource constraints meant that some patients did not undergo all possible investigations (e.g., bone marrow examination, advanced imaging), which may have contributed to residual "unexplained anemia". Fourth, we used simple screening tools for cognitive and mood assessment rather than detailed neuropsychological batteries.

Despite these limitations, the study highlights important clinical messages: anemia is common in older adults attending tertiary-care facilities; iron deficiency and chronic disease remain dominant causes; and anemia severity is closely linked to functional status and geriatric syndromes. These findings reinforce the view that anemia in the elderly is a marker of underlying disease and vulnerability, not an inevitable consequence of ageing.

Clinical and Public Health Implications for the practicing clinician, the present study underscores the need to actively search for anemia in older patients, even when symptoms are subtle or non-specific. Routine hemoglobin estimation, particularly in those with fatigue, functional decline, falls or cognitive complaints, should be incorporated into geriatric assessment. Once anemia is detected, a structured evaluation to identify nutritional deficiencies, occult blood loss, chronic inflammatory or renal disease and medication-related causes is warranted.

Timely identification and correction of iron deficiency (through dietary counselling and iron supplementation) and vitamin B12/folate deficiency, treatment of underlying chronic disease and rationalization of potentially contributory medications may improve functional outcomes and quality of life. Given the associations between anemia and falls, frailty, and cognitive impairment, addressing anemia should form part of multimodal interventions aimed at promoting healthy ageing.

CONCLUSION

Anemia is a common and clinically important problem in the geriatric population. In this hospital-based study of 100 patients aged 60–89 years, iron-deficiency anemia and anemia of chronic disease emerged as the leading causes, with normocytic and microcytic patterns predominating. Anemia severity showed significant associations with frailty, functional dependence, falls and cognitive impairment, highlighting its multifaceted impact on the health and independence of older adults.

Our findings support the concept that anemia in the elderly should not be dismissed as a normal part of ageing but should prompt thorough evaluation for underlying nutritional deficiencies, chronic inflammatory or renal disease and medication-related factors. Integrating anemia screening and management into comprehensive geriatric assessment and public health strategies has the potential to improve functional outcomes, reduce morbidity and enhance quality of life in this vulnerable population. Further large-scale, longitudinal studies are warranted to better define optimal diagnostic and therapeutic approaches to anemia in older persons.

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