

Clinical Profile of Anemia and Its Impact on Functional Capacity and Cognition among the Elderly

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Abstract

Background: Anemia is highly prevalent among elderly individuals and may accelerate functional decline and cognitive impairment. **Objective:** This study aimed to evaluate the clinical profile of anemia and its impact on functional capacity and cognition in elderly patients. **Materials and Methods:** A case-control study was conducted among 50 elderly patients with anemia and 50 age- and sex-matched controls without anemia. Functional capacity was assessed using the Katz activities of daily living (ADL) and Lawton instrumental activities of daily living (IADL) scales, whereas cognition was evaluated using the Montreal Cognitive Assessment (MOCA). **Results:** The mean age was 69.8 years with a female preponderance. Iron deficiency anemia was the most common type, with nutritional deficiency and reduced dietary intake as the leading causes. Elderly individuals with anemia had significantly higher odds of impairment in ADL (odds ratio [OR] 15.8, 95% confidence interval [CI] 6.2–40.1), IADL (OR 10.62, 95% CI 4.5–25.0, and cognition (OR 9.75, 95% CI 3.9–24.3) compared to controls. **Conclusion:** Anaemia substantially increases the risk of functional dependence and cognitive decline in elderly individuals. Early detection and management are essential to preserve independence, reduce caregiver burden, and improve quality of life.

Keywords: Activities of daily living, anemia, cognition, elderly, functional capacity, montreal cognitive assessment

INTRODUCTION

Anemia is a common condition among the elderly, with various causes.^[1] It is more than just a laboratory finding; it is a complex syndrome with significant effects on morbidity, mortality, and quality of life. The causes of anemia in older adults are often complicated, involving nutritional deficiencies, chronic kidney disease, chronic inflammation, and bone marrow disorders. Importantly, anemia in this age group is frequently overlooked, as symptoms such as fatigue, weakness, and shortness of breath are often attributed to the natural ageing process.^[2]

The clinical profile of anemia in geriatric patients shows a predominance of normocytic anaemia, followed by microcytic and macrocytic subtypes, reflecting various underlying causes.^[2,3] Studies from tertiary care centers in India have identified iron deficiency anaemia as the most common type, often worsened by chronic comorbidities and age-related declines in nutrient absorption.^[2] Beyond

haematological parameters, anemia significantly impacts functional capacity. Reduced hemoglobin levels are closely linked to reduced muscle strength, decreased physical performance, and an increased risk of falls.^[3] These functional impairments contribute to frailty, disability, and dependency, increasing the chances of institutionalization and hospitalization.^[4]

Equally concerning is the impact of anemia on cognition. Several studies have demonstrated links between anemia and cognitive decline, dementia, delirium, and depression.^[5] The underlying mechanisms involve reduced cerebral oxygen delivery, which impairs neuronal metabolism and synaptic function. Cognitive impairment caused by anemia further worsens geriatric syndromes, leading to decreased independence and poorer health outcomes.^[6]

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Given its dual impact on physical and cognitive areas, anemia is a key factor in healthy ageing. Recognizing its clinical profile in elderly patients is crucial for early detection, risk assessment, and targeted treatment. This study aims to describe the clinical features of anemia in older adults and to assess its effects on functional ability and cognition, thereby aiding the development of evidence-based strategies to enhance outcomes in ageing populations.

MATERIALS AND METHODS

This prospective case–control study was conducted at a tertiary care hospital over 6 months, from April 2022 to September 2022. The objective was to assess the clinical profile of anaemia and its effect on functional capacity and cognition in elderly patients.

The study protocol was approved by the institutional ethics committee (Vide letter number BLDE (DU)/IEC/691/2022-23) before starting the study. Written informed consent was obtained from all participants before enrollment.

A total of 100 participants were enrolled, including 50 cases and 50 controls. Cases consisted of elderly patients aged 60 years and above diagnosed with anemia according to the WHO criteria (hemoglobin <13 g/dL in men and <12 g/dL in women).^[7] Controls were age- and sex-matched elderly individuals without anaemia, recruited from the same hospital setting. Patients with acute hemorrhage, recent blood transfusion, or refusal to give informed consent were excluded from the study. Demographic and clinical information, such as age, sex, comorbidities, and hematological parameters, was recorded using a structured proforma. Functional capacity was assessed with the WHO standardized scales, including Katz activities of daily living (ADL) and Lawton instrumental activities of daily living (IADL), whereas cognitive function was evaluated using the Montreal Cognitive Assessment (MOCA). Laboratory investigations involved complete blood count, peripheral smear, serum ferritin, Vitamin B12, and renal function tests to determine the etiology and type of anemia.

Statistical analysis

All data were entered into Microsoft Excel spreadsheets and analyzed using SPSS trial version 28.0 (IBM Corp., Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages, whereas continuous variables were presented as means and standard deviations. Normality of data distribution was tested using the Kolmogorov–Smirnov and Shapiro–Wilk tests. The association between anemia status and clinical variables was analyzed using Chi-square tests (or Fisher’s exact tests where appropriate), with the strength of association expressed as odds ratios (ORs) and 95% confidence intervals (CI). $P < 0.05$ was considered statistically significant.

RESULTS

Baseline characteristics

The study included 100 elderly participants, equally divided into 50 with anaemia and 50 age- and sex-matched

nonanemic controls [Table 1]. The average age of participants was 69.8 years, with most between 65 and 75 years old. Females were more common in both groups, reflecting the higher prevalence of anaemia among elderly women in India. Matching controls ensured similar demographic characteristics, improving the validity of comparisons. No significant differences were observed in baseline age or sex distribution between the groups, confirming that outcome differences were due to anemia status.

Clinical profile of anaemia

Among cases of anemia, iron deficiency anemia was the most common, accounting for nearly half of the participants [Table 2]. This was followed by anemia of chronic disease and anemia of chronic kidney disease. A smaller proportion of patients had less common causes, such as myelodysplastic syndrome or mixed anemia. Nutritional deficiency and reduced dietary intake were identified as the main causes, often worsened by chronic comorbidities and age-related decline in nutrient absorption. These findings highlight the multifactorial nature of anemia in the elderly, where nutritional deficiencies interact with chronic inflammatory and renal conditions to cause significant declines in hemoglobin levels.

Functional capacity assessment

Functional capacity was assessed using the Katz Index of ADL and the Lawton IADL. The Katz ADL scale, which evaluates basic self-care tasks such as bathing, dressing, toileting, and feeding, revealed a significant difference between cases and controls. Thirty-four participants with anemia showed impairment in one or more ADL areas, compared to only six among the controls (OR 15.8, 95% CI 6.2–40.1), indicating that individuals with anemia were nearly 16 times more likely to face difficulties with basic daily activities than their nonanemic counterparts [Table 3]. This finding highlights the

Table 1: Baseline characteristics

	Total (n=100)	Cases (n=50)	Controls (n=50)
Age distribution			
60–69	40	20	20
70–79	40	20	20
80–89	18	9	9
90–99	2	1	1
Gender			
Male	40	20	20
Female	60	30	30

Table 2: Clinical profile of anemia

Types of anemia	Cases (%)
Iron deficiency anemia	22 (44)
Vitamin B-12 anemia	11 (22)
Anemia of chronic inflammation/anemia of chronic disease	12 (24)
Anaemia of chronic kidney disease	4 (8)
Myelodysplastic syndrome	1 (2)

considerable impact of anemia on physical independence, as even modest reductions in hemoglobin can weaken muscle strength and physical performance, leading to notable limitations in self-care.

The Lawton IADL scale, which evaluates more complex activities essential for independent living – such as shopping, meal preparation, housekeeping, and financial management – also revealed significant differences between the two groups. Thirty-eight elderly participants with anemia were impaired in one or more IADL areas, compared to only eight in the control group, OR 10.62 (95% CI 4.5–25.0), indicating that anemic elderly are more than eleven times as likely to depend on others for IADL [Table 3]. These results emphasize that anemia not only impacts basic self-care but also impairs the ability to perform complex tasks vital for independence in the community.

Cognitive assessment

Cognitive function was assessed using the MoCA. The results showed that 36 elderly participants with anemia exhibited cognitive decline, compared to only 7 among the controls (OR 9.75, 95% CI 3.9–24.3), indicating that elderly individuals with anemia were nearly 10 times more likely to experience cognitive impairment than those without anemia [Table 3]. This finding is particularly important because cognitive decline in the elderly not only affects memory and executive function but also increases dependence on caregivers and the risk of adverse outcomes such as falls, medication errors, and social isolation. The strong association between anemia and cognitive decline observed in this study supports the hypothesis that reduced oxygen delivery to brain tissue contributes to neuronal dysfunction and worsens age-related cognitive decline.

Taken together, the results show that anaemia in the elderly is linked to a significant increase in the risk of both functional and cognitive impairment. The OR derived from the Katz ADL, Lawton IADL, and MoCA assessments consistently indicate a ten- to sixteen-fold higher risk among elderly participants with anemia compared to controls. These findings provide strong evidence that anaemia is not just a laboratory abnormality but a clinically meaningful condition that directly affects the quality of life and independence of elderly individuals. The prevalence of iron deficiency anaemia emphasises the importance of addressing nutritional factors, while the role of chronic diseases highlights the need for integrated management strategies.

Stratified analysis by anaemia severity

To further explore the relationship between anemia severity and functional and cognitive impairment, we classified elderly participants with anemia into mild, moderate, and severe groups based on WHO criteria. Among the 50 cases with anemia, 4 had mild anemia, 10 had moderate anemia, and 36 had severe anemia. The distribution of impairments across ADL, IADL, and MoCA domains is summarized below in Table 4. These findings demonstrate a clear dose–response relationship, with increasing anemia severity associated with greater impairment in both functional and cognitive domains.

Table 3: Cognitive and functional domains (n=50)

Domain	Cases impaired	Controls impaired	OR (95% CI)	P
ADL	34 (68)	6 (12)	15.8 (6.2–40.1)	<0.001
IADL	38 (76)	8 (16)	10.62 (4.5–25.0)	<0.001
MoCA	36 (72)	7 (14)	9.75 (3.9–24.3)	<0.001

ADL: Activities of daily living, IADL: Instrumental activities of daily living, MoCA: Montreal cognitive assessment, CI: Confidence interval, OR: Odds ratio

Table 4: Stratified analysis by severity of anaemia

Anaemia severity (Hb in g/dL)	ADL impairment (n=34), n (%)	IADL impairment (n=38), n (%)	MOCA impairment (n=36), n (%)
Mild			
Men (11.0–12.9)	1 (3)	3 (8)	0
Women (11.0–11.9)	1 (3)	2 (5)	1 (3)
Moderate (8.0–10.9)*	10 (29)	11 (29)	5 (14)
Severe (<8)*	22 (65)	22 (58)	30 (83)

*Indicates both men and women. ADL: Activities of daily living, IADL: Instrumental activities of daily living, MoCA: Montreal cognitive assessment, Hb: Hemoglobin

DISCUSSION

The current study examined the clinical profile of anemia in older adults and its connection to functional capacity and cognitive performance. Our results demonstrate a strong and consistent link between anaemia and both functional dependence and cognitive decline, with ORs ranging from 9.75 to 15.8 across ADL, IADL, and MoCA domains. These findings support the view that anaemia is not just a blood disorder but a major geriatric syndrome with significant effects on physical, cognitive, and functional health.

The mean age of participants in our study was 69.8 years, with a higher proportion of women among both cases and controls. This demographic pattern reflects findings from Indian studies, where elderly women tend to have a higher prevalence of anaemia due to nutritional deficiencies, chronic illnesses, and postmenopausal physiological changes.^[1,2] Iron deficiency anaemia was the most common subtype in our cohort, followed by anaemia of chronic disease and anaemia associated with chronic kidney disease. These results align with those of Shrivastava *et al.*^[1] and Prakash *et al.*,^[2] who also identified iron deficiency as the primary cause in older adults. Macedo *et al.*^[3] further emphasised the multifactorial nature of anaemia among community-dwelling elderly, highlighting its strong connection to decreased functional capacity.

Our study revealed significant disparities in functional outcomes between elderly participants with and without anaemia. Impairment in ADL and IADL was notably higher among anaemic individuals, with ORs of 15.8 and 10.62, respectively. These findings align with extensive literature demonstrating that anaemia contributes to functional decline,

frailty, and disability. Guralnik *et al.*^[4] identified anemia as a common condition in older adults and an independent predictor of functional decline. Shah *et al.*^[5] similarly found that anemia accelerates the decline in daily functioning, whereas Atti *et al.*^[6] showed that anemia increases the risk of dementia, indirectly worsening functional dependence.

The broader evidence base further supports these associations. The WHAS study by Guralnik *et al.*^[4] established anaemia as an independent predictor of mortality, emphasising its role as a marker of physiological vulnerability. Kung *et al.*^[8] conducted a comprehensive meta-analysis and confirmed that anemia significantly increases the risk of both functional and cognitive impairment. Wangping *et al.*^[9] extended these findings to the oldest-old population, demonstrating that anaemia is associated with functional decline and all-cause mortality. Portugal-Nunes *et al.*^[10] highlighted the importance of iron status in maintaining functional ability, whereas Abd-Elaziz *et al.*^[11] reported that anaemia was strongly linked to poor functional outcomes in elderly patients. Gattas *et al.*^[12] provided mechanistic insights, showing that low hemoglobin adversely affects both brain and muscle function, thus offering biological plausibility for the observed functional impairments.

Sex-specific studies further reinforce our findings. Karismaz *et al.*^[13] demonstrated that anaemia significantly increased dependence in ADL and IADL among older women, whereas Karismaz *et al.*^[14] reported similar associations in older men, emphasising the role of dynapenia as a mediating factor. Patel and Guralnik^[15] highlighted the prognostic implications of anaemia, noting its association with reduced physical performance and disability. Penninx *et al.*^[16] also confirmed that anaemia contributes to decreased physical performance and increased disability, supporting the robust relationship observed in our study.

Cognitive impairment was also significantly more common among participants with anaemia in our cohort, with an OR of 9.75. This supports the hypothesis that reduced cerebral oxygen delivery contributes to neuronal dysfunction and accelerates cognitive decline. Shah *et al.*^[5] demonstrated that anaemia independently predicts faster cognitive deterioration, whereas Atti *et al.*^[6] showed that anemia increases the risk of dementia even in cognitively healthy older adults. Kung *et al.*^[8] confirmed anemia as a significant risk factor for cognitive impairment and dementia in their meta-analysis. Wangping *et al.*^[9] also reported that anemia was linked to cognitive decline and higher mortality in the oldest-old. Portugal-Nunes *et al.*^[10] and Abd-Elaziz *et al.*^[11] both emphasized the role of iron deficiency in poorer cognitive outcomes, whereas Gattas *et al.*^[12] provided evidence that low hemoglobin directly harms cognitive brain function.

Our stratified analysis showed that severe anaemia (hemoglobin <8 g/dL) was disproportionately associated with impairment, accounting for 65% of ADL decline, 58% of IADL dependence, and 83% of cognitive impairment among participants with anaemia. This dose–response pattern supports the hypothesis

that lower haemoglobin levels exacerbate functional and cognitive decline in elderly individuals.

However, it is important to note that while anemia showed strong associations with decline, comorbidities may have acted as potential confounders. Conditions such as diabetes, hypertension, and chronic kidney disease were present in both groups and may independently contribute to reduced physical and cognitive performance. Although our study matched cases and controls for age and sex, comorbidity burden was not adjusted for in the analysis. This limitation highlights that the observed associations, while significant, cannot be attributed solely to anaemia. Future studies with larger sample sizes and multivariate models are needed to disentangle the independent effects of anaemia from those of coexisting chronic diseases. Taken together, the findings of our study, supported by extensive evidence across diverse populations, demonstrate that anaemia in older adults is strongly associated with both functional and cognitive impairment. The consistently elevated ORs across ADL, IADL, and MoCA assessments emphasize the magnitude of this association. The predominance of iron deficiency anemia in our cohort highlights the importance of addressing nutritional deficiencies, whereas the contributions of chronic disease and renal impairment underscore the need for comprehensive, multidisciplinary management strategies. Early identification and correction of anaemia may therefore play a critical role in preserving functional independence, preventing cognitive decline, and improving overall quality of life in the ageing population.

Limitations of the study

This study has certain limitations. The sample size was small, with 50 cases and 50 controls, which may limit the generalizability of the findings. The case–control design prevents establishing causality, although the strong associations observed suggest a likely causal relationship. Only the cases and controls were matched for age and sex; comorbidities were not matched, which could influence the outcomes.

CONCLUSION

The study showed that anemia in the elderly is strongly linked to functional and cognitive decline. Elderly people with anaemia were found to be sixteen times more likely to experience difficulty with basic ADL, eleven times more likely to become dependent in IADL, and ten times more likely to suffer cognitive decline compared to controls. Iron deficiency anaemia was the most common type, with nutritional deficiency and reduced dietary intake as the main causes. These findings highlight the urgent need for early diagnosis and treatment of anaemia in elderly populations, especially in developing countries where the burden of anaemia is high and resources for elderly care are limited. Addressing anemia may help preserve independence, delay cognitive decline, and improve the overall quality of life for older adults.

Author contributions

APA supervised the study, oversaw project administration, and contributed to manuscript review and editing. VS was

responsible for data collection, methodology, formal analysis, investigation, and data curation, as well as drafting the original manuscript and visualizations. AU contributed to methodology, validation, resources, and manuscript review and editing. All authors have read and approved the final version of the manuscript.

The main findings of this study were presented at the BLDE (Deemed to be University) Research Paper Competition in Vijayapura, Karnataka, India. The abstract was included in the official proceedings of the competition.

Data availability statement

The datasets generated and analyzed during this study are not publicly available due to patient privacy and confidentiality agreements. However, they can be obtained from the corresponding author upon reasonable request.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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