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Research paper

Anemia prevalence and hematologic findings in German geriatric inpatients – results of the prospective cross-sectional multicenter study "GeriAnaemie 2013"

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ABSTRACT

Objectives: Anemia is a frequent finding in older patients, associated with increased morbidity. Hematologic data of German geriatric inpatients are scarce. This cross-sectional multicenter study was issued by the German Geriatric Society to evaluate hematologic findings and possible causes of anemia in German geriatric inpatients.
Methods: Five hundred and seventy-nine geriatric inpatients, consecutively recruited in 6 participating German study centers; patient characteristics and laboratory parameters were obtained on admission. Inclusion criteria: geriatric in-patient ≥70 years; exclusion criteria: actual cancer disease or cancer associated treatment. Anemia definition according to WHO criteria. Definition of anemia severity according to National Cancer Institute reference values. Anemia subtypes were defined and divided into renal anemia, anemia of chronic diseases, iron deficiency anemia and anemia associated with vitamin B12 deficiency or deficiency of folic acid. Myelodysplastic syndrome (MDS) was suspected in case of anemia in combination with leucopenia or low platelets.
Results: Overall, prevalence of anemia was 55.1% (319/579 patients), mean serum hemoglobin value 11.9 g/dL. Anemia was mainly mild (72.7%) and normocytic (70.2%). MDS was suspected in 27 patients (8.5%), with 10 being macrocytic. Anemia of chronic diseases (ACD) was the most prevalent subtype of anemia (8.2%); multicausality can be assumed in many patients. MCV based classification was heterogenous in all anemia subtypes.
Conclusion: Anemia was mainly normocytic, mild and highly prevalent in this patient cohort, could not always be specified; multicausality was supposed; MCV appeared to be inappropriate for pathogenetical assignment of anemia subtypes in older patients. Further research in geriatric hematologic particularities is needed.

Abbreviations: Absolute ID, Absolute iron deficiency; ACD, Anemia of chronic disease; CRP, C-reactive protein; Ery, Erythrocyte count; FA, Folic acid; FAA, Folic acid associated anemia; Functional ID, Functional iron deficiency; GFR, Glomerular filtration rate; Hb, Hemoglobin; IDA, Iron deficient anemia; MCV, Mean corpuscular volume; MDS, Myelodysplastic syndrome; NAA, Not assigned anemia; RA, Renal anemia; RPI, Reticulocyte production index; TSAT, Transferrin saturation; VB12A, Vitamin B12 associated anemia; VitB12, VitaminB12.

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1. Introduction

Anemia is a frequent finding in older patients and is associated with increased mortality, increased morbidity and risk of frailty [1–3]. Several international studies have shown that prevalence of anemia varies depending on the population considered. A study of the third National Health and Nutrition Examination survey (NHANES 1991–1994) showed an anemia prevalence of > 20% among community dwelling seniors > 85 years [4]. A more recent study among Indian home-dwelling people was consistent with this finding [5]. A systematic review by Gaskell et al. [6] among geriatric inpatients > 65 years living in developed countries found an anemia prevalence of 40%. Bach et al. [7] showed a comparable prevalence of anemia among Austrian geriatric in-patients aged ≥90. In their study cohort, anemia of chronic disease (ACD) prevailed and anemia was predominantly normocytic and mild [7]. However, data respecting anemia prevalence and hematologic findings like anemia severity or type of anemia among German geriatric inpatients are still rare and mostly derive from monocentric studies. The presumed high prevalence of anemia [8,9] with associated comorbidities among the increasing population of aged patients will be a challenge for clinicians in the near future. Until now, there is no general recommendation for diagnostic and therapeutic steps in connection with anemia in geriatric patients [10]. The German Geriatric Society therefore decided to initiate the first multicenter study on anemia prevalence among German geriatric inpatients. Primary objective of this study was to evaluate the prevalence of anemia. Further objectives were the analysis of hematological parameters and red blood cell indices to assess type and severity of anemia and possible causes for anemia.

2. Patients and methods

Between June 2013 and December 2014, a number of 598 geriatric inpatients were consecutively recruited on admission in six participating German study centers (5 geriatric centers and 1 general emergency department of a university hospital). Recruitment interval was 4 to 6 weeks in every study center at varying seasonal times. Included were patients > 70 years admitted to the geriatric department or – in case of the general emergency department – purposed to be admitted to a geriatric department. The patient cohort was broadly based on geriatric inpatients, who were transferred from other departments (e.g. after having undergone surgery) or admitted to the geriatric department either by practicing doctors or as an emergency. All study patients gave written informed consent. Patients with actual cancer disease or actual cancer associated treatment were not included in the study. Of the 598 patients, 579 met with study criteria and were included in the study. Of the 19 excluded patients, 4 had no written informed consent and 15 were < 70 years old. Hematologic relevant parameters were analysed in every center-associated laboratory department. They included: hemoglobin (Hb) (g/dL), erythrocyte count (ery) (mio/μL), reticulocytes (‰), hematocrite (%), mean corpuscular volume (MCV) (fL), serum iron (μg/dL), ferritin (μg/L), c-reactive protein (CRP) (mg/L), folic acid (FA) (ng/mL), creatinine (mg/dL), vitamin B12 (vitB12) (ng/L), and transferrin saturation (TSAT) (%). Additional data was gathered concerning patients' gender and age. Reference values for definition of anemia and subtype characteristics were taken from published literature: anemia was defined according to WHO criteria (females < 12 g/dL, males < 13 g/dL); severity of anemia was defined according to National Cancer Institute (NCI) scale (> 10–12 g/dL [women] and > 10–14 g/dL (men) "mild", 8–10 g/dL "moderate", 6.5–7.9 g/dL "severe", < 6.5 g/dL "very severe"). Based on MCV, anemia was classified microcytic (MCV < 78 fL), normocytic (78 fL < MCV ≤ 94 fL) or macrocytic (MCV > 94 fL). Definitions of anemia subtypes were rather restrictive to avoid overlap and exclude multifactorial pathogenesis: iron deficient anemia (IDA) was defined if ferritin < 30 μg/L and TSAT < 16% ([12]; for the definition of ACD we required ferritin > 650 μg/L in addition to CRP > 5 mg/L to exclude overlap with IDA and avoid an overestimation of ACD due to age-associated higher levels of ferritin [11,12]. Due to the increasing prevalence of chronic kidney disease (CKD) among patients > 70 years, interpretability of TSAT becomes difficult in connection with ACD and renal anemia (RA) and was therefore not considered [13], As glomerular filtration rate (GFR) was not estimated routinely in the study centers, it was calculated based on MDRD short formula (GFR = 170 × creatinine – 1.154 × age – 0.203 × (0.742 [females]) [12]. RA was defined GFR < 30 mLl/min and ferritin > 30 μg/L to exclude overlap with IDA.

Folic acid (FAA) or vitamin B12 (VB12A) associated anemia were defined if folic acid was < 3 ng/mL [14] or vitamin B12 < 200 ng/L and GFR > 30 mL/min and CRP < 5 mg/L to avoid overlap with RA and ACD. Not assigned anemia (NAA) was defined if study parameters did not allow assignment to any form of anemia. Absolute iron deficiency (absolute ID) was defined ferritin < 30 μg/L, TSAT < 16% and absence of anemia; functional iron deficiency (functional ID) was defined ferritin > 650 μg/L, TSAT < 16%, CRP > 5 mg/L and absence of anemia [12]. In functional ID, we had to consider TSAT due to lack of other iron parameters in these study patients. Myelodysplastic syndrome (MDS) was suspected if anemia was associated with either leucopenia (< 4.000/μL) or low platelet count (< 150.000/μL) according to the characteristics of this malignant bonemarrow disorder [15]. For the definition of anemia types, we did not consider MCV because of previous findings, showing that MCV is not an adequate parameter for pathogenetic assignment of anemia in older patients [7]. Reticulocyte production index (RPI) was calculated (RPI = [reticulocytes (%) * hematocrit]/[45 * shift]) to esteem bone marrow insufficiency, defined RPI < 2. For calculation, reticulocyte count in ‰ was converted to %.

Completed CRFs were sent to study central in Cologne for evaluation. Database was created by means of Research Electronic Data Capture (REDCap®). Statistical analysis was carried out by means of the IBM SPSS statistics version 22.

Centers were compared by Anova for normally distributed data, Kruskal-Wallis-test for not normal distributions and nominal data by Chi^2 test. Descriptive numbers are mean ± standard deviation or median with inter quartile range (IQR). Categorical variables were analysed by Chi^2 or Fisher-test, as appropriate, if group totals were > 5. A P-value < 0.05 was defined as significant.

This study is registered in the German Clinical Trials Registry (DRKS, Freiburg) with no. DRKS00004617. The Ethics Committee of the University Hospital Cologne approved of the study (no. 12-322; 13.2.2013). The study was carried out in accordance with the current version of the Declaration of Helsinki of 2013.

3. Results

The study patient cohort consisted of 579 patients with 391 females (67.5%) and 188 males (32.5%). Anemia was found in 319 of 579 (55.1%) patients, with 205 females (64.3%) and 114 males (35.7%) (Tables 1a and 1b). Mean age of study patients was 81.9 years (70 to 97 years, standard deviation [SD]: 6.2). Anemic patients had a mean age of 82.0 years (70 to 96 years; SD: 6.1). Most patients had normocytic, mild anemia. According to study definition, ACD was the most common form of anemia found in this study population. Due to restrictive definitions and lack of hematologic and anemia related parameters in the 319 anemic