Association between hematologic parameters and functional impairment among geriatric inpatients: Data of a prospective cross-sectional multicenter study ("GeriPrävalenz2013")

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ABSTRACT

Objectives: Objective of this study was to analyse the association between impairment of Barthel Index items and hematologic parameters in geriatric inpatients.
Methods: Patient recruitment of the "GeriPrävalenz2013" study has been described before. Inclusion criteria: in-patient aged > = 70 years; exclusion criteria: actual cancer disease or cancer associated treatment. Anemia was defined according to WHO criteria. Physical impairment was assessed by Barthel Index (BI). Association between all 10 items of the BI and hematologic parameters was statistically evaluated.
Results: Anemia prevalence was 55.1% (319/579) with BI impairment in 96.2% patients. T-test revealed significant lower BI in anemic patients (47.9 vs 54.3; p = 0.004). Binary logistic regression revealed that growing age, reduced MCV, reduced iron levels and reduced Hb levels were associated with increased impairment of several items of the Barthel-Index. Interestingly, increased levels of albumin and folic acid (FA) were associated with increased impairment of BI items.
Conclusion: Anemia and lower levels of anemia related parameters showed a negative impact on ADL and physical performance based on BI items. An impaired total BI should result in an analysis of BI subitems, particularly if anemia related laboratory parameters are deviant. Reasons for the negative impact of elevated FA and albumin levels on BI remain speculative.

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1. Introduction

Anemia is a frequent finding in older patients and association with functional deficits has been described [1,2]. Data of physical impairment in anemic German geriatric inpatients, however, is scarce [3]. Most of the study groups evaluating association between functionality and anemia in older patients apply Barthel Index (BI)

for assessment of physical impairment [4]. "Functional evaluation: the Barthel Index". Md Med J 14: 61–65. The BI is part of the comprehensive geriatric assessment (CGA) and an established assessment tool, measuring the performance of activity of daily living. Ten performance items are used describing mobility and activity of daily living. Every item is rated and assigned a number of points. A high number of points (maximum 100 points) is associated with more independence in everyday life and less dependence on assistant help [4]. As the original version of BI had shown some weaknesses [5], several modified versions were developed. The Hamburg Classification Manual is a standardized and consensus-based oper-

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ationalization of the BI and has been developed for application in German geriatric medicine [6]. Assessment of functional impairment in this study is based on the Hamburg Classification Manual for the BI.

As numerous previous studies have revealed significant impairment of overall results of BI score in anemic patients, this study analyses every single item of BI for impairment by anemia associated hematologic parameters. Primary objective of this study was to evaluate the impact of Hb values on impairment of the ten items. Secondary objective of this study was to evaluate impacts of several hematologic variables on impairment of the ten BI items.

Data derives from the cross-sectional multicenter study "GeriAnämie2013", which has been issued by the German Geriatric Society to evaluate hematologic findings in German geriatric inpatients. It is registered in the German Clinical Trials Register (DRKS, Freiburg) with No. DRKS00004617. The local 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.

2. Patients and methods

Recruitment of patients for "GeriAnämie2013" has been described before [7]: 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 4–6 weeks in every study center. 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. All study patients gave informed consent. Patients with actual cancer disease or actual cancer associated treatment were not included in the study. Nineteen patients were excluded due to age <70 years or no written informed consent. The remaining 579 patients met with study criteria. Anemia associated hematologic parameters were analysed in every center-associated laboratory department on admission. The blood draw was part of a routine blood draw for standard of care at admission in every study center. The parameters included: hemoglobin (Hb) (g/dl), erythrocyte count (ery) (mio/μl), hematocrit (%), mean corpuscular volume (MCV) (fl), serum iron (μg/dl), ferritin (μg/l), folic acid (FA) (ng/ml), creatinine (mg/dl), vitaminB12 (vitB12) (ng/l), serum albumin (g/dl) and transferrin saturation (TSAT) (%). Additional data was gathered concerning patients' sex and age. Anemia was defined according to WHO criteria (females <12 g/dl, males <13 g/dl); severity of anemia was defined according to NCI scale (>10 g/dl mild, 8–9.9 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); deficiency of serum albumin was defined <3.5 g/dl, deficiency of VitB12 was defined < 200 ng/l, folic acid was defined <3 ng/ml; drug intake was elevated if > = 5 drugs/day were taken.

Assessment of physical ability was carried out based on BI on admission. The ten performance items of the BI check for [8]

1. Presence of impairment with feeding (<10 points).
2. Presence of impairment with transfers (<15 points).
3. Presence of impairment with grooming (<5 points).
4. Presence of impairment with use of toilet (<10 points).
5. Presence of impairment with bathing (<5 points).
6. Presence of impairment with walking/wheel chair use (<15 points).
7. Presence of impairment with climbing stairs (<10 points).
8. Presence of impairment with dressing (<10 points).

Table 1
Barthel Index and anemia associated hematologic study parameters (metric) (n = number of patients, mean value and standard deviation (SD)).

	N	Mean or median	Standard deviation (SD) or quartiles
Barthel Index	579	51.33	26.53
Erythrocytes Mio/μl	579	3.94	0.63
Hemoglobin g/dl	579	11.90	1.90
Hematocrit%	579	35.60	5.57
MCV fl	579	90.83	6.50
Iron μg/dl	461	53.0	37.0–75.0
Ferritin μg/l	445	157.0	83.2–291.8
Transferrin-saturation%	426	21.0	14.0–29.0
Folic acid ng/ml	468	5.8	4.2–8.9
Creatinine mg/dl	574	1.1	0.8–1.4
Vitamin B12 ng/l	469	433	311–655
Albumin g/dl	462	3.19	0.60

9. Presence of fecal incontinence (<10 points).
10. Presence of urinary incontinence (<10 points).

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.

Groups were compared by t-test for normally distributed data, Mann Whitney U test for not normal distributions and nominal data by Chi-Square test. Descriptive numbers are mean ± standard deviation, median (inter quartile range) or frequencies, accordingly. Predictors for the outcome of the 10 BI items were analyzed by multivariable binary logistic regression. Additionally to all examined blood parameters gender and age were considered. Potential predictors with a p-value < = 0.05 in a Spearman (Pearson for gender) correlation analysis were selected for the respective BI item regression model. The final models were calculated by stepwise backward selection, calculating adjusted odds ratios (OR).

3. Results

Anemia was found in 319 of 579 (53.3%) patients (205 female, 114 male). Anemic patients were between 70 and 97 years old, with a mean age of 81.9 years (standard deviation (SD) 6.23). 52.4% of women and 60.6% of men were anemic according to WHO criteria. Anemia was mainly mild and normocytic. BI was evaluated in all 579 patients with a mean value of 51.33 points (SD 26.53). Description of Barthel Index and items as well as the 11 metric and 5 nominal anemia associated hematologic study parameters are shown in Tables 1 and 2.

The most frequent impairment seen in this study group was impaired stair climbing (42.7%), followed by impaired bathing (40.6%). The least prevalent impairment was seen in connection with feeding (18%) and fecal continence (15.4%).

Student's t-test revealed that anemic patients have a significant lower BI than not-anemic patients (47.9 and 54.3, respectively; p = 0.004).

In the multivariable regression analyses for BI items gender was not included because no association was found with any item at all. Overall in the final models age and five anemia related parameters were associated with impairment of BI items: growing age was associated with increased impairment of feeding (1.07 (1.03; 1.12)), impairment of dressing (OR 1.03 (0.99; 1.06)) and with fecal incontinence (OR 1.05 (1.00; 1.09)); although for impairment of dressing age failed to be a significant predictor (p = 0.055), it was considered due to better model accuracy.

Among the anemia related parameters a reduction of MCV, iron levels and Hb levels was associated with increased impairment: reduced MCV impaired feeding (OR 0.94 (0.90;0.98)), grooming