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## Research paper

# Agreement between fecal occult blood test and virtual colonoscopy in the diagnostic procedure of anemia in elderly patients



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## ABSTRACT

**Introduction:** The aim of this study was to evaluate the agreement between a biomarker, the fecal occult blood test (FOBT), and an instrumental examination, virtual colonoscopy, in the diagnosis of anemia in elderly patients.

**Material and methods:** From June 2011 to July 2012, 660 patients 65 years and older were admitted to the acute Geriatric Unit of the Spedali Civili in Brescia (Italy): 90 of them affected by anemia of unknown origin at hospital admission (hemoglobin values less than 13 g/dL in males and 12 g/dL in females) were included in the present study and performed a computed tomography of the colon (CTC).

**Results:** Eighty-nine patients out of 90 were able to perform correctly the CTC. Thirty-five out of 89 patients (39%) had a positive result in the FOBT. CTC showed that 27% had a source of bleeding from the lower gastrointestinal tract. One hundred percent of patients with positive CTC had positive FOBT, while only 17% with negative CTC had positive FOBT ( $P < 0.001$ ).

**Conclusions:** Finding positive FOBT in anemic older patients is a strong indication to perform a virtual colonoscopy. The combination of the FOBT and CTC may lead to an adequate number of examinations without losing diagnostic capacity, avoiding unnecessary testing and reducing costs.

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## 1. Introduction

Due to the gain in life expectancy, the geriatric population is increasing worldwide. It has been estimated that by 2020 people over 65 years will account for 16% of the population in North America and for one third of the European population [1]. Alongside, over the last century, chronic health problems have replaced infectious disease as the dominant health care burden, as most chronic conditions are strongly related to aging [2]. Anemia, for example is frequent in the elderly, with a prevalence ranging from 2.9 to 61% depending on the case studies analyzed and increasing with age [3]. Anemia is associated with adverse outcomes in elderly people, such as falls, frailty, cognitive impairment, hospitalization and mortality, even for slightly low values of hemoglobin [4–6]. Besides, the mistaken assumption that anemia

is physiological in the elderly, the presence of other morbidities and a decreased perception of symptoms often lead to an underestimation of the clinical problem. One of the main causes of anemia in old age is iron deficiency due to bleeding from the gastrointestinal tract, rather than a deficiency intake [7,8]. Thus, the determination of martial deficiency anemia should always be followed by the search of a potential source of bleeding. Barium enema, sigmoidoscopy and colonoscopy optics have been used for decades as primary examinations for the evaluation of the lower gastrointestinal tract. More recently, a number of new imaging techniques have been developed, such as the computed tomography of the colon (CTC), or virtual colonoscopy, designed in 1994 by David Vining [9,10]. Virtual colonoscopy has been suggested as a method for colorectal cancer screening in asymptomatic adults at intermediate risk of disease, in those not willing to undergo optical colonoscopy as a primary screening modality, or in patients in whom colonoscopy is not proved diagnostics [11,12]. Conventional colonoscopy in the elderly has several limitations: the number of incomplete colonoscopies increases with the age of patients; in some cases it cannot be performed due to significant comorbidities, hemorrhagic diathesis, allergic reactions during previous sedations, high anesthesiologic

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risk; bowel preparation may be poorly tolerated, and able to alter the fluid and electrolyte balance of the patients. Thus, CTC might be a good choice in this part of the population as a diagnostic procedure of anemia [13–17].

The aim of this study was to evaluate the agreement between a biomarker, the occult blood fecal test, and an instrumental examination, virtual colonoscopy, in the diagnosis of anemia in elderly patients.

## 2. Materials and methods

From June 2011 to July 2012, 660 patients 65 years and older were admitted to the acute Geriatric Unit of the Spedali Civili in Brescia (Italy): 90 of them affected by anemia of unknown/uncertain origin were included in the present study. Anemia was defined as hemoglobin values less than 13 g/dL in males and 12 g/dL in females, according to the WHO criteria [18].

Exclusion criteria were the following: patients affected by malignancy or hematopoietic diseases, patients with a glomerular filtration rate less than 30 mL/min, and those with a medical record of an optical colonoscopy performed in the 6 months prior the admission.

All the patients signed informed consent.

All the patients underwent an extensive clinical evaluation, pulmonary x-ray, electrocardiogram and routine blood tests. Moreover, for the purpose of the study, serum iron (ug/dL), ferritin (ng/mL), unsaturated iron-binding capacity (%), transferrin (mg/dL), vitamin B12 (pg/mL), folic acid (ng/mL), carcinoembryonic antigen (ng/mL), fecal occult blood test (performed with both fecal immunochemical method than with guaiac test) were analyzed.

CTC is an high spatial resolution examination of the abdomen-pelvis, with low radiological exposure performed after colic preparation and air insufflations; the data acquired by CT are re-evaluated at a computerized work station that process multi-dimensional images of the colon. CTCs were performed at the Radiology Unit of Spedali Civili of Brescia, always by the same operator, after a preparation protocol agreed. A diet free of waste was prescribed within 3 days before the exam, and meglumine diatrizoate (100 mL) with a dual function was administrated the day of examination: the latter marks the fecal residue on CT and at the same time acts as a laxative. The visceral distension was obtained after the administration of spasmolytic agent (Butylscopolammonium bromide) with insufflations of CO<sub>2</sub> by means of an automatic pump. Statistical analysis: group differences in demographic and clinical characteristics were tested using *t*-test and Chi<sup>2</sup> test.

## 3. Results

Of the 90 patients included, 66 were females and 24 males. The mean age of the patients was 82.9 years (ranging from 70 to 98 years). Eighty-nine patients out of 90 were able to perform correctly the CTC; the only patient who did not finish the exam was not able to hold the injected CO<sub>2</sub>. Table 1 describes the main sociodemographic and clinical characteristics of the sample. The mean hemoglobin value was 10.4 mg/dL [standard deviation (SD) ± 1.3]. Thirty-five out of 89 patients (39%) had a positive result in the fecal occult blood test. Findings from the CTC showed that 24 out of 89 patients (27%) had a source of bleeding from the lower gastrointestinal tract: 12 neoplastic disease, 5 inflammatory bowel disease, 4 ischemic colitis, 3 acute diverticulitis. Patients were divided into two groups: those with positive or negative virtual colonoscopy. There was a significant difference in sex distribution: in the group with positive CTC, 13 out of 24 patients (54%) were males and 11 out

**Table 1**  
Sociodemographic and clinical characteristics of the sample.

Variables	Values ± standard deviation
Age	82.92 ± 6.02
Sex (M/F)	24/65
Hemoglobin (g/dL)	10.42 ± 1.33
Platelets	235.57 ± 91.15
Glycemia (mg/dL)	107.79 ± 34.67
Creatinine (mg/dL)	1.34 ± 0.79
Cholesterol (mg/dL)	158.46 ± 47.78
INR	1.34 ± 0.79
Alanine transaminase (UI/L)	17.38 ± 12.55
Carcinoembryonic antigen (ng/mL)	4.35 ± 3.89
Albumin (g/dL)	3.22 ± 0.49
Serum iron (ug/dL)	38.72 ± 21.85
Ferritin (ng/mL)	227.98 ± 352.51
Transferrin (mg/dL)	209.63 ± 75.04
Folic acid (ng/mL)	7.9 ± 6.36
Vitamin B12 (pg/mL)	408.15 ± 252.82
White blood cell	8.18 ± 3.81
FOBT (±)	35/54

M: male; F: female; FOBT: fecal occult blood test.

of 24 (46%) were females; in the group with negative CTC, 11 out of 65 patients (17%) were males and 54 out of 65 (83%) were females ( $P < 0.001$ , OR for positive CTC due to male gender = 3.09). Age, hemoglobin, inflammatory markers, iron, vitamin B12 and folic acid did not significantly differ between the two groups; on the contrary, the value of serum albumin was  $3.37 \pm 0.4$  g/dL in patients with negative CTC, and  $2.81 \pm 0.4$  g/dL in patients with positive CTC ( $P < 0.001$ ).

There was difference in the detection of positivity of fecal occult blood test: 24 of 24 patients with positive CTC (100%) had positive fecal occult blood test, while only 11 of 65 patients with negative CTC (17%) had positive fecal occult blood test ( $P < 0.001$ ) (Table 2). Thus, the presence of a positive fecal occult blood test had a sensitivity of 100% and a specificity of 83%, with a positive predictive value of 68.5% and a negative predictive value of 100%.

## 4. Discussion

In this study, prevalence of anemia of unknown origin was quite high affecting 90 out of 660 hospitalized patients during the study period (13.6%). Seventy-five percent of patients with anemia had iron deficiency, which could be explained either by a nutritional deficiency or by a chronic loss from the gastrointestinal tract. Indeed, 39% of our patients with anemia of unknown origin had a positive occult blood in the stool test; moreover, the latter was strongly associated with a positive CTC.

Patients with positive and negative CTC did not significantly differed either in age or mean values of hemoglobin, indicating that the severity of blood loss was not correlated with the presence of lesions of the lower gastrointestinal tract.

There was a statistically significant difference in distribution of sex, with a higher prevalence of male patients with positive CTC, being in line with previous reports on colon and rectum disease [19]. The majority of CTC were positive for neoplastic disease or

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