Short communication

Prevalence of sarcopenia in older patients with colorectal cancer

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ABSTRACT

Objective: Sarcopenia is the age-related loss of muscle mass, strength, and function. It is a common finding in older patients and is associated with decreased life expectancy and potentially higher susceptibility to chemotherapy toxicity. This study describes the prevalence of sarcopenia in older adults with early stage colorectal cancer.

Materials and Methods: Patients ≥70 years old who underwent surgical resection for stage I–III colorectal cancer between 2008 and 2013 were identified from the medical record. Sarcopenia was assessed by measuring the total muscle area on computerized tomography (CT) images obtained prior to surgery. Total muscle area was measured at the level of L3 and normalized using each patient's height to produce a skeletal muscle index (SMI). Sarcopenia was defined using sex- and body mass index (BMI)–specific threshold values of SMI.

Results: Eighty-seven patients were included, with a median age of 77 years (70–96). Twenty-five men (60% of 42) and 25 women (56% of 45) had sarcopenia. Sarcopenic patients had significantly lower BMI ($p = 0.03$) compared to non-sarcopenic patients. There was a positive correlation between BMI and SMI for both men ($r = 0.44$) and women ($r = 0.16$).

Conclusion: Sarcopenia is highly prevalent among older patients with early stage colorectal cancer. BMI alone is a poor indicator of lean body mass and improved methods of screening for sarcopenia are necessary. CT scans are a viable option for identifying sarcopenic patients in whom timely interventions may improve survival, quality of life, and functional outcomes.

Introduction

Sarcopenia is the age-related loss of muscle mass. The prevalence of sarcopenia in community dwelling adults ranges from 13% to 24% in those under age 70 to more than 50% in persons over the age of 70.[1] In the elderly, sarcopenia may lead to frailty and is predictive of impairments in instrumental and basic activities of daily living (IADL, ADL), falls, and death.[2,3] As both cancer and sarcopenia are associated with advancing age, it is important to assess whether an elderly patient with cancer is sarcopenic as this is related to reduced survival, poor response to chemotherapy, and increased chemotherapy toxicity.[4]

The study presented here pertains to older patients with a colorectal cancer diagnosis. Of the estimated 143,460 new patients with colorectal cancer in 2012, about half were age 70 or older.[5] Patients with early stage (stage I–III) colorectal cancer are offered surgical resection with or without adjuvant chemotherapy, depending on the depth of invasion and involvement

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of lymph nodes. In patients with non-metastatic colorectal cancer, sarcopenia has been linked to postoperative infection and delayed recovery.[6] Despite the prevalence and negative outcomes of sarcopenia, there is little data on its frequency in older patients with early stage colorectal cancer.

The purpose of this study is to define the prevalence of sarcopenia in older adults with early stage colorectal cancer. The specific focus is patients age 70 and older because they are at especially high risk for poor outcomes due to diminished physiologic reserves. The study uses computed tomography (CT)—a procedure used in routine management of colorectal cancer—to measure lean body mass in patients age 70 and older.

Materials and Methods

Design

This study is a cross-sectional analysis of CT data collected routinely in the diagnosis and treatment of patients with colorectal cancer. This study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill.

Population Cohort and Data Acquisition

Study Participants
Eligible patients were treated at the North Carolina Cancer Hospital between 2008 and 2013, and met the following criteria: (1) ≥70 years of age at the time of stage I–III colorectal cancer diagnosis, (2) underwent surgical resection of their cancer (patients undergoing transanal excision for stage I cancers were excluded from the study), (3) had a CT scan of the abdomen that had been reviewed and stored electronically at UNC Hospitals and performed ≤42 days before surgical treatment, and (4) at least one visit to a medical or surgical oncologist at UNC Hospitals.

Data Collection
For each patient, a retrospective chart review was conducted of their UNC Hospitals' electronic medical record to collect patient characteristics (height, weight, body mass index [BMI], race) measured pre-operatively, CT images, and date of surgery.

Body Mass Index (BMI)
BMI was calculated using the following formula: BMI = weight (kg)/height^2 (m^2). BMI categories typically applied to adults were used to classify the patients as follows: <20.0 kg/m^2, underweight; 20.0 to 24.9 kg/m^2, normal weight; 25.0 to 29.9 kg/m^2, overweight; and ≥30.0 kg/m^2, obese.

Sarcopenia
Sarcopenia was assessed by measuring the cross-sectional area of the abdominal wall (rectus abdominis, transversus abdominis, internal and external obliques), psoas, and paraspinal (erector spinae, quadratus lumborum) muscles on CT images obtained for diagnostic and staging purposes in patients with colorectal cancer. Total muscle area was measured at the level of L3 using a three-dimensional computerized image analysis software, Aquarius iNtuition 4.4 (TeraRecon, San Mateo, CA).

Measurements were performed in a semi-automated fashion with manual outlining of muscle borders and volumetric analysis of the outlined area by setting a density threshold between −30 and +110 Hounsfield units (HU) (Fig. 1). Automatic calculation of total muscle area was performed by excluding vasculature, bony structure, and areas of intramuscular fatty infiltration based on HU. The measured muscle area was then normalized for height (in meters) to calculate a skeletal muscle index (SMI) (cm^2/m^2). The CT images were processed and analyzed by a single radiologist, to minimize measurement error.

Sarcopenia was defined using sex- and BMI-specific threshold values of SMI (men with BMI <25, 43 cm^2/m^2; men with BMI ≥25, 53 cm^2/m^2; women regardless of BMI, 41 cm^2/m^2). These cut points were identified in the largest analysis of skeletal muscle to date in a predominately colorectal cancer population using optimal stratification for cut points in relation to increased mortality.[7]

Statistics

Differences between groups were analyzed using independent t-tests, Fisher's exact test, and Pearson's chi-square tests. Correlations between continuous variables were assessed using Pearson correlation coefficients. Results were considered statistically significant at the $p < 0.05$ level.

Results

Sample

Of patients diagnosed with non-metastatic colorectal cancer (N = 1,029), 218 were 70 years or older at time of diagnosis. Of the patients age 70 or older (N = 218), 214 had adenocarcinoma or mixed endocrine carcinoma and 197 met the surgery criteria (17 patients undergoing transanal excision for stage 1 disease were excluded). One hundred had an abdominal CT scan within 42 days prior to surgery; however, only 87 were technically adequate for SMI assessment.

The sample was distributed roughly evenly between males (n = 42) and females (n = 45), and mean age was 78 (SD 5.6) and 80 years (SD 6.5), respectively. Sixty-nine patients (79%)
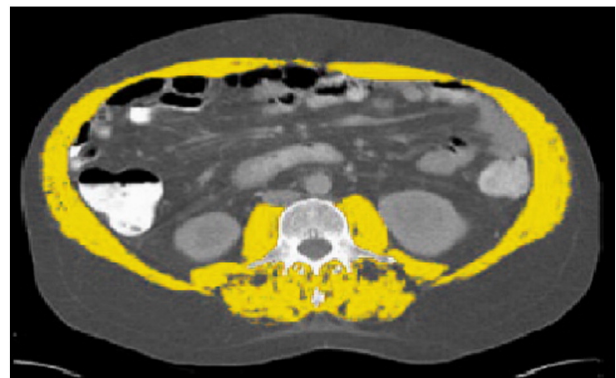
Fig. 1 – CT scan at L3. The highlighted area was used to calculate skeletal muscle index.