Received: 12 March 2024 | Accepted: 11 April 2024

DOI: 10.1002/jso.27652

RESEARCH ARTICLE

Journal of SURGICAL ONCOLOGY WILEY

Accuracy of surgeons for predicting radiological sarcopenia in colorectal cancer surgery

Arthur Foinquinos Krause Gonçalves MD, MS[1] | Ana Beatriz Diniz de Barros MD[1] | Lucas Miranda Castro MD[2] | Joanna Brayner Dutra MD[2] | Thales Paulo Batista MD, PhD[3] | Antônio Cavalcanti de Almeida Martins MD, PhD[1] | Maria Julia Gonçalves Mello MD, PhD[4] | Cristiano de Souza Leão MD, PhD[1]

[1]Department of Surgery, Instituto de Medicina Integral Professor Fernando Figueira (IMIP), Recife, Brazil

[2]Department of Radiology, Instituto de Medicina Integral Professor Fernando Figueira (IMIP), Recife, Brazil

[3]Department of Surgery, Universidade Federal de Pernambuco (UFPE), Recife, Brazil

[4]Department of Clinical Research, Instituto de Medicina Integral Professor Fernando Figueira (IMIP), Recife, Brazil

Correspondence
Thales Paulo Batista, MD, PhD, Department of Surgery, Universidade Federal de Pernambuco (UFPE), Av Prof Moraes Rego, 1235, ZIP 50670-901, Recife – PE, Brazil.
Email: t.paulo@outlook.com

Abstract

Background: This study explored the performance of surgeons for predicting radiological sarcopenia as accessed by psoas cross-sectional area in patients with colorectal cancer (CRC).

Methods: A cross-sectional study was carried out and a diagnostic accuracy strategy was applied using the radiologist team assessment as gold standard.

Results: Cohort analysis of 45 consecutive patients found that 31.1% had sarcopenia. Correlation of *Total Psoas Index* between radiologists and surgeons was *very strong* for the Junior and *strong* for the Senior surgeon, with a *strong* correlation between the surgeons. By the simplistic criterion, agreement between radiologists and surgeons was *substantial* for both the Junior and Senior surgeons, with a *moderate* level between the surgeons. Sensitivity, specificity, positive predictive value, negative predictive value, and accuracy of Junior surgeon were 92.9%, 83.9%, 72.2%, 96.3%, and 86.7%, respectively. The corresponding results for the Senior surgeon were 78.6%, 90.3%, 78.6%, 90.3%, and 86.7%, respectively. We found no major differences on agreement levels and performance of surgeons using the composite criterion.

Conclusions: Surgeons seem to be accurate for identifying radiological sarcopenia in patients with CRC. The simplistic criterion should be preferred since a composite criterion adds complexity without increasing accuracy or agreement levels.

KEYWORDS

CT scan, colorectal neoplasms, frailty, malnutrition, sarcopenia, X-ray

Partial data of this study were presented during the XVI Brazilian Congress of Surgical Oncology, BSSO/SBCO—Brazilian Society of Surgical Oncology, Rio de Janeiro, November 15–18, 2023.

1 | INTRODUCTION

Colorectal cancer (CRC) is the most common gastrointestinal malignancy and a leading cause of mortality due to cancer worldwide.[1,2] In patients suffering of this malignancy, caloric intake is frequently limited by local mechanical effects and the nutrition status is also systemically impaired through cancer-related inflammation and consumption. As consequence of malnutrition and senility, the progressive loss of muscle mass and function characteristics of sarcopenia occurs in many patients diagnosed with CRC, which consequently impacts surgical outcomes contributing to high rates of postoperative adverse events and decreased survival after colonic and rectal resections.[3–6]

Radiologically assessed psoas muscle mass has been proposed as a surrogate for sarcopenia and an objective assessment of impaired nutritional status,[7] helping surgeons to identify frail patients at high risk of perioperative morbidity and to guide perioperative nutritional interventions. The cross-sectional view of the psoas muscle provides an easy-to-measure marker of sarcopenia that can be accessed in the same abdominopelvic computed tomography (CT) scans used for preoperative staging and surgical planning. Applying a simplified concept, the area of both psoas muscles at the third lumbar vertebra is normalized for the patient's height and used to identify those cases with sarcopenia.[3,4] This method offers a practical and objective mean of assessing sarcopenia, takes only a few minutes to perform and can be readily measured and reproduced in clinical practice.[3,4,7]

However, from a radiologist's perspective, the detailed description of the increasing number of parameters required by surgical teams along the treatment planning is a tedious procedure not prioritized in daily clinical work and therefore more suited to research settings and academic hospitals.[3,8] In these settings, we hypothesized that sarcopenia can be simply assessed using patient's preoperative CT scan and that surgeons can be accurate for identifying sarcopenic patients with CRC.[7,9,10] Accordingly, this study aimed to explore the performance of surgeons for predicting sarcopenic psoas muscle mass in our clinical environment using two different sex-specific thresholds to diagnose the presence of sarcopenia.

2 | METHODS

A cross-sectional study was carried out and a diagnostic accuracy strategy was applied to assess the performance of surgeons for predicting radiological sarcopenia in CRC surgeries. Following the STARD statement —*Standards for Reporting of Diagnostic Accuracy Studies* (https://www.equator-network.org/reporting-guidelines/stard/), we re-explore the psoas cross-sectional area as a predictor of sarcopenia in preoperative CT scans of patients who were consecutively operated at the Instituto de Medicina Integral Professor Fernando Figueira—IMIP from March 2019 to June 2020. This study was reviewed by our Ethics Research Committees (reference no. CAAE 31470619.8.0000.5201, acceptance protocol 4.238.707; August 26, 2020), and involves the colorectal cohort of our project assessing the nutritional status in patients with gastrointestinal malignancies. A written informed consent was obtained from all patients and the procedures complied with the standards of current ethical guidelines.

For the scope of this current analysis, we limited our study to adults (≥18 years) with histologically proven adenocarcinoma of the colon or rectum, and excluded those cases in which CT scans were not accessible to review. As part of our prospectively observational study, we assessed and recorded clinical data in electronic spreadsheets. For assessment of radiological sarcopenia, preoperative abdominal CT scans within 90 days of surgery were retrospectively reviewed using the Vue PACS Image Viewer, version 12.2.2.1025 (Carestream Health, Inc. 2014) by a duo of senior and resident radiologists working together (Castro LM and Dutra JB), and this data were used as the gold-standard for the diagnosis of sarcopenia. A pair of surgeons—senior (Gonçalves AFK) and junior (Barros ABD) were then trained to measure the total psoas area (TPA) at the mid-level of the third lumbar vertebra. This area was normalized for patient's height to calculate the total psoas index (TPI) and the concept of radiological sarcopenia was explored using dichotomic methods based on sex-specific cutoffs (i.e., simplistic criterion)[3] and sex-specific thresholds stratified by the presence of obesity (i.e., composite criterion),[4] as previously reported.

The observers were blind to each other and performed three times the manual outlining of both the left and right psoas muscle borders to reach a median value for every psoas area (Figure 1). These measurements were then used to calculate the TPI (TPI = TPA/height^2). In both cases, values were rounded in the electronic spreadsheets to explore the presence of sarcopenia. Radiological sarcopenia was defined as a TPI lower than 545 mm/m^2 for males and lower than 385 mm/m^2 for females (i.e., simplistic criterion).[3] Secondarily, sarcopenia was also explored using a composite criterion as the TPI lower than 523 mm/m^2 for males or 386 mm/m^2 for females who were not obese (BMI, <30), and a TPI lower than 543 mm/m^2 for males or 466 mm/m^2 for females who were obese (BMI, ≥30).[4]

Continuous variables were summarized as medians (interquartile range) and categorical variables as frequencies (percent). Comparisons were conducted using the Mann–Whitney *U* test for continuous variables and $\chi 2$ tests for categorical variables, as appropriate. Relationship of the psoas areas and TPI between observers was explored by Pearson's correlation coefficient. The accuracy analysis was based on frequency data and diagnostic agreement of the observers. We determined sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were the proportion of accurate predispositions. The agreement levels for definition of sarcopenia between the observers were also analyzed by the Kappa (κ) statistics.

Statistical analyses were performed using The JAMOVI Project (2023) v.2.3, a free and open statistical platform available at https://www.jamovi.org. The conventional consensus scheme for strength of agreement by κ-values was used in the evaluation—0, no agreement; 0–0.19, poor; 0.2–0.39, fair; 0.4–0.59, moderate; 0.6–0.79, substantial; and 0.8–1, excellent.[11] Similarly, the strength of correlations by ρ-values were classified as very strong (0.91–1), strong (0.71–0.9), moderate (0.51–0.7), weak (0.31–0.5), very weak (0.01–0.3), and no

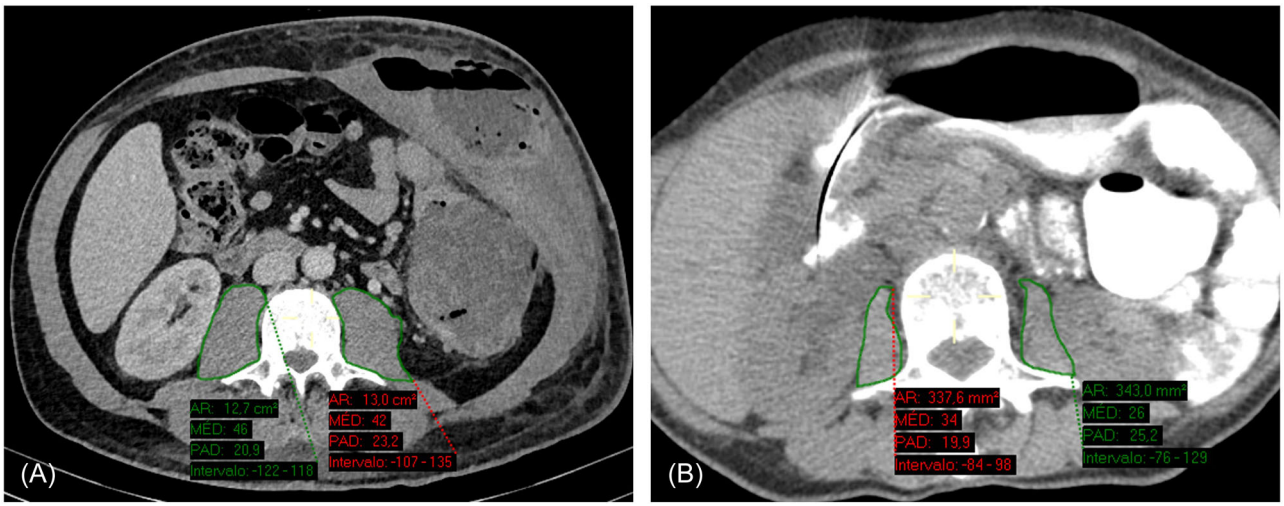

FIGURE 1 Computed tomography images at the L3 vertebral body showing the total psoas area measurements by the Junior surgeon in non-sarcopenic (A) and sarcopenic cases (B).

TABLE 1 Baseline demographic of patients.

Variable[a]	All	Radiological status[b]		*p* Value[c]
		Non-sarcopenic	Sarcopenic	
Age, years	65 (60–75)	65 (57–73.5)	70 (61–76.3)	0.411
Gender				
Female	24 (53.3)	15 (33.3)	9 (20)	0.322
Male	21 (46.7)	16 (35.6)	1 (11.1)	
Total psoas index	519 (405 – 657)	597 (452–679)	337 (315–453)	<0.001
Psoas area				
Left	635 (460–855)	786 (535–908)	400 (355–558)	<0.001
Right	588 (476–786)	667 (543–868)	409 (330–551)	<0.001
Body mass index	24.6 (20.7–27.3)	26.1 (22.9–28.7)	20.8 (18.4–24.8)	0.003
Tumor location				
Colon	23 (51.1)	15 (33.3)	8 (17.8)	0.586
Rectum	22 (48.9)	16 (35.6)	6 (13.3)	

[a]Variable expressed as median (IQR, interquartile range) or *n* (%).
[b]Radiological status by the radiologist team assessment using the simplistic criterion.
[c]Mann–Whitney *U* test or chi-square test, as appropriate.

correlation (zero), as previously reported.[12] All analyses considered a statistically significant two-tailed *p* value of 0.05.

3 | RESULTS

From our prospective database of 100 patients with gastric and CRC who were consecutively invited to participate in our observational study, 61 underwent surgical treatment for CRC and 45 of them had CT scans in the hospital's repository and fitted the criteria of this analysis. Those excluded from the images review involved 12 patients who had evaluation in outpatient imaging centers (especially those from rural areas and those who had CT scans during the SARS-CoV-2, COVID-19 pandemic) and did not have their images accessible for analysis; three that had CT scans longer than 90 days of surgery; and one case that was missed in the imaging review process. The baseline demographic of the main clinical characteristics and radiological parameters for the cases of interest in this analysis are presented in Table 1.

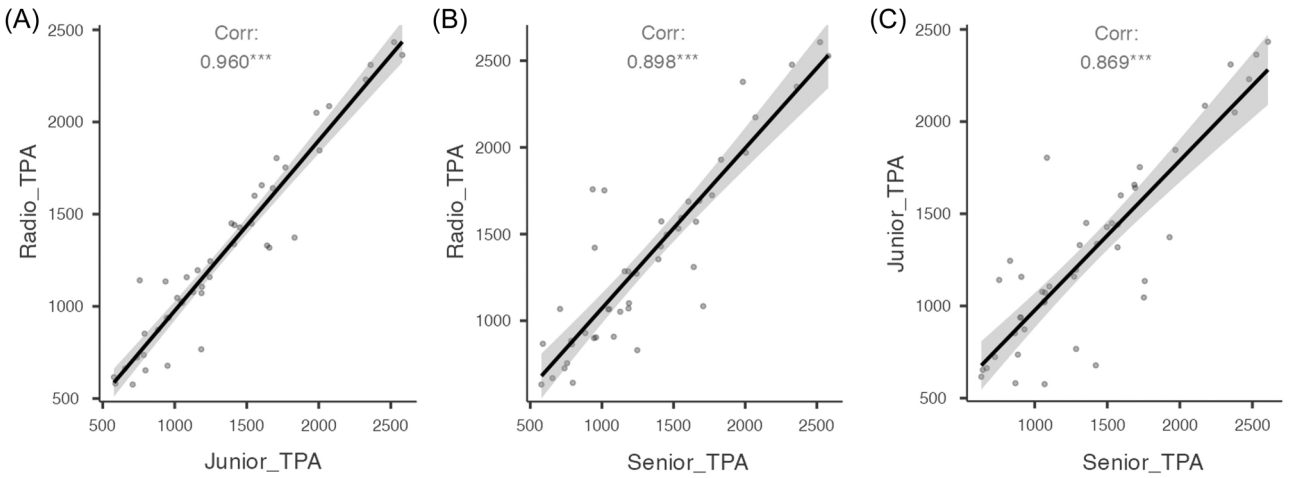

FIGURE 2 Summary of correlations for the total psoas area (TPA) between radiologists and Junior surgeon (A), radiologists and Senior surgeon (B), and between the surgeons (C).

Median TPI was 519 mm^2/m^2 (IQR 405–657), 492 mm^2/m^2 (IQR 409–624), and 530 mm^2/m^2 (IQR 412–666) for radiologists, junior, and senior surgeons, respectively. Accordingly, the comparisons between radiologists and junior surgeon ($p = 0.729$), radiologists and senior surgeon ($p = 0.608$), and between the surgeons ($p = 0.417$) reached no statistically significant difference for the TPI. Correlation of TPI between radiologists and surgeons' assessment was "very strong" for the Junior surgeon ($\rho = 0.937$, 95% confidence interval [CI] = 0.965–0.888; $p < 0.001$) and "strong" for the Senior surgeon ($\rho = 0.815$, 95% CI = 0.894–0.685; $p < 0.001$), with a "strong" correlation between the surgeons ($\rho = 0.774$, 95% CI = 0.870–0.632; $p < 0.001$). Similarly, high correlation coefficients were found for the assessment of the left ($\rho = 0.931$, $\rho = 0.872$, and $\rho = 0.849$; respectively) and the right ($\rho = 0.968$, $\rho = 0.903$, and $\rho = 0.874$; respectively) psoas areas, respectively; with all correlations reaching a significant level of $p < 0.001$. A graphical summary of correlations for the TPA is also presented in Figure 2. Herein, correlation between radiologists and junior surgeon, radiologists and senior surgeon, and between the surgeons were "very strong" ($\rho = 0.960$, 95% CI = 0.978–0.928), "strong" ($\rho = 0.898$, 95% CI = 0.943–0.820) and "strong" ($\rho = 0.869$, 95% CI = 0.926–0.773), respectively; with all correlations reaching a significant level of $p < 0.001$.

The overall level of agreement for sarcopenia between the simplistic and composite criteria according to the radiologist team assessment (i.e., gold-standard) was 91% ($\kappa = 0.793$, $p < 0.001$), with prevalence reaching 31.1% ($n = 14/45$) with both the criteria. Overall agreement among the three raters was "substantial" ($\kappa = 0.637$, $p < 0.01$) and "moderate" ($\kappa = 0.595$, $p < 0.01$) according to the simplistic and composite criteria, respectively. Applying the simplistic criterion, the agreement level between radiologists and surgeons was "substantial" for both the Junior surgeon ($\kappa = 0.712$, $p < 0.01$) and the Senior surgeon ($\kappa = 0.689$, $p < 0.01$), with a "moderate" agreement level between the surgeons ($\kappa = 0.519$, $p < 0.01$). Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy of Junior surgeon were 92.9%, 83.9%, 72.2%, 96.3%, and 86.7%, respectively. The corresponding results for the Senior surgeon were 78.6%, 90.3%, 78.6%, 90.3%, and 86.7%, respectively. The summary of the agreement levels and performance of surgeons using the composite criterion is shown in Supporting Information: Tables 1 and 2.

4 | DISCUSSION

Radiologically assessed psoas muscle mass has garnered attention as a surrogate marker for sarcopenia and emerged as a valuable approach for predicting surgical outcomes. In this current study, we found a meaningful correlation of the psoas cross-sectional area measurements between radiologists and surgeons with clinically relevant levels of agreement for identifying patients with radiological defined sarcopenia. We also confirm the psoas muscle mass assessment in ordinary abdominal CT scans is very reproducible for clinical practice, working as an easy-to-measure, quick, and effective tool to assess nutritional status by either senior or junior surgeons. Of note, we found a high prevalence of sarcopenia and a high overall diagnostic accuracy of surgeons for predicting radiological sarcopenia, which did not change between the two different simplified methods for definition of sarcopenia we have explored.

Radiologically assessed sarcopenia is a frequent condition in oncology with a prevalence of about 35% in patients with different malignant solid tumors.[13,14] In gastrointestinal oncology patients, sarcopenia in staging CT scans ranges from 2.1% to 83.3% depending on diagnostic cutoff points of different criteria,[14] with a prevalence of 28.3%–46.77% in patients suffering from CRC.[5,13,15] Accordingly, we found a prevalence of 31% in this current study using both a simplistic criterion based on sex-specific cutoffs[3] and composite sex-specific thresholds stratified by the presence of obesity.[4] Based on these reported high rates of sarcopenia and its value for predicting surgical complications[14,16,17] and oncological outcomes,[14,18] cross-sectional imaging methods for assessing sarcopenic loss of muscle

mass should be incorporated into the daily practice as a cornerstone to improve the management of patients with colorectal malignancies.

The most common imaging techniques to evaluate body composition are DEXA (i.e., dual X-ray absorptiometry), sonography, magnetic resonance imaging, and CT scan. However, CT scans have become a common diagnostic tool for the radiological assessment of sarcopenia since a large muscle area is included in exams that are routinely collected for surgical planning and oncological staging.[19] Despite there is no standardized definition of radiological sarcopenia, most of the studies use a semiautomated method to measure the cross-sectional area of all truncal muscles or just the area of the psoas muscles as a simplified method, both at the L3–L4 levels.[3,4,19] These methods of measurement proved to be very feasible with a good level of intra and interobserver agreement amongst radiologists,[7,9,10] but whether such approaches are reproducible for other medical specialists requires further evaluation.[9] Recently, MacLaine et al.[9] compared these two CT scan-derived assessment methods and found the simplified approach based on the psoas-areas measurement is very feasible for non-radiologists and even for medical students. Accordingly, we found that both senior and junior surgeons can be very accurate for identifying radiological sarcopenia in patients with CRC using a simplistic criterion based on the total psoas and sex-specific cutoffs.

The strengths of this study include the merit of conducting the first accuracy analysis exploring the surgeons' performance for predicting radiological sarcopenia in a specific cohort of patients with CRC. Additionally, since much of the variability on muscle measurements in CT scans is due to the choice of different slices by the observers,[10] averaging three slices for each measurement was applied to improve the psoas-area assessment in comparison to the single slice approach. Nevertheless, we also highlight this study lacks external validity as a single-center analysis including a relatively small number of patients. Implications for practice and future research of our study involve the potential for helping surgeons to identify by themselves the patients with radiological sarcopenia that need personalized oncological and multidisciplinary care. We also present some bases to facilitate further analysis on the predictive value of combining radiological sarcopenia with other systemic markers of inflammation and nutritional risk, such as hypoalbuminemia, which may improve our ability to identify patients with CRC and poor prognosis.[20,21]

5 | CONCLUSIONS

Surgeons seem to be accurate for identifying radiological sarcopenia in preoperative CT scans of patients with CRC. The simplistic criterion based only on sex-specific thresholds should be preferred as the affordable method since a composite criterion stratified by the presence of obesity adds complexity without increasing accuracy or agreement levels.

AUTHOR CONTRIBUTIONS

Arthur Foinquinos Krause Gonçalves: Formal analysis; investigation; data curation; writing—original draft; writing—review and editing; visualization. **Ana Beatriz Diniz de Barros**: Formal analysis; investigation; writing—original draft; writing—review and editing. **Lucas Miranda Castro**: Formal analysis; investigation; writing—original draft; writing—review and editing. **Joanna Brayner Dutra**: Formal analysis; investigation; writing—original draft; writing—review and editing; visualization. **Thales Paulo Batista**: Conceptualization; methodology; formal analysis, investigation, data curation, writing—original draft; writing—review and editing; supervision. **Antônio Cavalcanti de Almeida Martins**: Formal analysis; investigation; writing—original draft; writing—review and editing, visualization. **Maria Julia Gonçalves Mello**: Formal analysis; investigation; writing—original draft; writing—review and editing; visualization; supervision. **Cristiano de Souza Leão**: Formal analysis; investigation; writing—original draft; writing—review and editing; visualization; project administration.

ACKNOWLEDGMENTS

The authors would like to thank Dr Marcelo Henrique Ferreira Fernandes for helping us with data collection.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The authors have no plan to make individual participant data (IPD) available to other researchers since data sharing was not required in the study protocol initially reviewed and approved by our Ethics Research Committee (Institutional Review Boards).

ORCID

Arthur Foinquinos Krause Gonçalves http://orcid.org/0000-0002-4082-603X
Ana Beatriz Diniz de Barros http://orcid.org/0009-0000-7295-8865
Lucas Miranda Castro http://orcid.org/0000-0001-9334-4053
Joanna Brayner Dutra http://orcid.org/0000-0003-1784-9433
Thales Paulo Batista http://orcid.org/0000-0001-5320-3205
Antônio Cavalcanti de Almeida Martins http://orcid.org/0000-0002-1249-8622
Maria Julia Gonçalves Mello http://orcid.org/0000-0003-4645-8343
Cristiano de Souza Leão http://orcid.org/0000-0003-2989-117X

TWITTER

Thales Paulo Batista @BatistaTP

REFERENCES

1. Siegel RL, Miller KD, Wagle NS, Jemal A. Cancer statistics, 2023. *CA Cancer J Clin*. 2023;73(1):17-48. doi:10.3322/caac.21763

2. Santos MO, Lima FCS, Martins LFL, et al. Estimated cancer incidence in Brazil, 2023-2025. *Rev Bras Cancerol*. 2023;69(1):e213700. doi:10.32635/2176-9745.RBC.2023v69n1.3700
3. Richards SJG, Senadeera SC, Frizelle FA. Sarcopenia, as assessed by psoas cross-sectional area, is predictive of adverse postoperative outcomes in patients undergoing colorectal cancer surgery. *Dis Colon Rectum*. 2020;63(6):807-815. doi:10.1097/DCR.00
4. Xiao J, Caan BJ, Cespedes Feliciano EM, et al. Association of low muscle mass and low muscle radiodensity with morbidity and mortality for colon cancer surgery. *JAMA Surg*. 2020;155(10):942-949. doi:10.1001/jamasurg.2020.2497
5. Li ZZ, Yan XL, Jiang HJ, et al. Sarcopenia predicts postoperative complications and survival in colorectal cancer patients with GLIM-defined malnutrition: analysis from a prospective cohort study. *Eur J Surg Oncol*. 2024;50(1):107295. doi:10.1016/j.ejso.2023.107295
6. Joglekar S, Nau PN, Mezhir JJ. The impact of sarcopenia on survival and complications in surgical oncology: a review of the current literature. *J Surg Oncol*. 2015;112(5):503-509. doi:10.1002/jso.24025
7. Jones KI, Doleman B, Scott S, Lund JN, Williams JP. Simple psoas cross-sectional area measurement is a quick and easy method to assess sarcopenia and predicts major surgical complications. *Colorectal Dis*. 2015;17(1):O20-O26. doi:10.1111/codi.12805
8. Sartor H, Bjurberg M, Asp M, et al. Imaging ovarian cancer—from baseline characteristics to high-risk image factors. *J Ovarian Res*. 2023;16(1):78. doi:10.1186/s13048-023-01154-w
9. Dale MacLaine T, Baker O, Omura M, Clarke C, Howell SJ, Burke D. Prospective comparison of two methods for assessing sarcopenia and interobserver agreement on retrospective CT images. *Postgrad Med J*. 2023;99(1171):455-462. doi:10.1136/postgradmedj-2021-141301
10. Perthen JE, Ali T, McCulloch D, et al. Intra- and interobserver variability in skeletal muscle measurements using computed tomography images. *Eur J Radiol*. 2018;109:142-146. doi:10.1016/j.ejrad.2018.10.031
11. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159-174. doi:10.2307/2529310
12. Mukaka MM. Statistics corner: a guide to appropriate use of correlation coefficient in medical research. *Malawi Med J*. 2012;24(3):69-71. doi:10.4314/MMJ.V24I3
13. Surov A, Wienke A. Prevalence of sarcopenia in patients with solid tumors: a meta-analysis based on 81,814 patients. *J Parenter Enteral Nutr*. 2022;46(8):1761-1768. doi:10.1002/jpen.2415
14. Su H, Ruan J, Chen T, Lin E, Shi L. CT-assessed sarcopenia is a predictive factor for both long-term and short-term outcomes in gastrointestinal oncology patients: a systematic review and meta-analysis. *Cancer Imaging*. 2019;19(1):82. doi:10.1186/s40644-019-0270-0
15. Nunes GD, Cardenas LZ, Miola TM, Souza JO, Carniatto LN, Bitencourt AGV. Preoperative evaluation of sarcopenia in patients with colorectal cancer: a prospective study. *Rev Assoc Med Bras (1992)*. 2023;69(2):222-227. doi:10.1590/1806-9282.20220339
16. Jones K, Gordon-Weeks A, Coleman C, Silva M. Radiologically determined sarcopenia predicts morbidity and mortality following abdominal surgery: a systematic review and meta-analysis. *World J Surg*. 2017;41(9):2266-2279. doi:10.1007/s00268-017-3999-2
17. Lieffers JR, Bathe OF, Fassbender K, Winget M, Baracos VE. Sarcopenia is associated with postoperative infection and delayed recovery from colorectal cancer resection surgery. *Br J Cancer*. 2012;107(6):931-936. doi:10.1038/bjc.2012.350
18. Chai VW, Chia M, Cocco A, Bhamidipaty M, D'Souza B. Sarcopenia is a strong predictive factor of clinical and oncological outcomes following curative colorectal cancer resection. *ANZ J Surg*. 2021;91(5):E292-E297. doi:10.1111/ans.16706
19. Boutin RD, Yao L, Canter RJ, Lenchik L. Sarcopenia: current concepts and imaging implications. *Am J Roentgenol*. 2015;205(3):W255-W266. doi:10.2214/AJR.15.14635
20. Almasaudi AS, Dolan RD, Edwards CA, McMillan DC. Hypoalbuminemia reflects nutritional risk, body composition and systemic inflammation and is independently associated with survival in patients with colorectal cancer. *Cancers*. 2020;12(7):1986. doi:10.3390/cancers12071986
21. Feliciano EMC, Kroenke CH, Meyerhardt JA, et al. Association of systemic inflammation and sarcopenia with survival in nonmetastatic colorectal cancer results from the C SCANS study. *JAMA Oncol*. 2017;3(12):e172319. doi:10.1001/jamaoncol.2017.2319

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Gonçalves AFK, de Barros ABD, Castro LM, et al. Accuracy of surgeons for predicting radiological sarcopenia in colorectal cancer surgery. *J Surg Oncol*. 2024;1-6. doi:10.1002/jso.27652