SARCOPENIA IN GASTRIC CANCER AND BODY COMPOSITION CHANGES AFTER GASTRECTOMY

SARCOPÉNIA NO CANCRO GÁSTRICO E MODIFICAÇÕES DA COMPOSIÇÃO CORPORAL PÓS-GASTRECTOMIA

MARGARIDA FERREIRA[1,2], ANA LÚCIA BARREIRA[1], FRANCISCO SARDINHA[3], JOÃO COSTA[3], JÉSSICA RODRIGUES[4,5], AFONSO GONÇALVES[3], PAULO MATOS COSTA[1,2]

1 Serviço de Cirurgia Geral – Hospital Garcia de Orta
2 Faculdade de Medicina da Universidade de Lisboa
3 Serviço de Imagiologia – Hospital Garcia de Orta
4 Grupo de Epidemiologia do Cancro – Instituto Português de Oncologia do Porto
5 Centro de Matemática (CMAT) – Universidade do Minho

ABSTRACT

Sarcopenia is the phenomenon of loss of muscle strength, muscle performance and muscle mass due to either age (primary sarcopenia) or other illnesses such as cancer (secondary sarcopenia). Sarcopenia has often been defined in the literature as low muscle mass. Sarcopenia among gastric cancer patients has been shown to carry a higher risk of post-operative complications and a higher overall and disease-specific mortality. Our study included 86 patients who underwent surgery for gastric cancer at our institution. Muscle mass was assessed by CT scan (L3 Muscle Index). A subgroup analysis was then performed of 39 patients who had had CT scans 12 months postoperatively. We collected demographic, clinical and body composition data. Sarcopenia was defined by the L3 Muscle Mass Index according to cut-off values previously defined in the literature. We found a prevalence of sarcopenia of 40.7% among gastric cancer patients undergoing gastrectomy. Sarcopenia was associated with a higher overall mortality. Nutritional risk and percentage of body weight lost did not identify sarcopenic patients. 51.4% of sarcopenic patients were overweight, 2.9% were obese. At 12 months post-operatively, 82.1% of patients lost weight and BMI and 76.9% of patients lost muscle mass (lower L3 muscle index) after gastrectomy. We did not find a significant association between the change in muscle mass, BMI or weight. We found that total gastrectomy was significantly associated to muscle mass loss compared to subtotal gastrectomy. We also found a significant association between advanced gastric cancer stage and muscle mass loss. We concluded that while sarcopenia is highly prevalent among gastric cancer patients after gastrectomy, the vast majority of patients lose weight and muscle mass. Since most patients will not improve muscle mass postoperatively it is crucial to implement prehabilitation strategies early on.

Keywords: *Sarcopenia, L3 Muscle Index, Gastrectomy, Gastric Cancer, Nutrition.*

RESUMO

A Sarcopénia é o fenómeno da perda de força, performance e massa muscular. Pode ser primário (relacionado com a idade) ou secundário (por exemplo a neoplasia) e tem sido definida na literatura como massa muscular baixa. A Sarcopénia nos doentes com cancro gástrico acarreta um aumento do risco de complicações pós-operatórias e da mortalidade específica e global. O nosso estudo incluiu 86 doentes submetidos a gastrectomia por cancro gástrico, cuja massa muscular foi avaliada por TC (Índice L3). Realizou-se uma subanálise de 39 doentes que tinham realizado TC também aos 12 meses pós-operatórios. Foram analisados

dados demográficos, clínicos e de composição corporal. A Sarcopénia foi definida pelo Índice de Massa Muscular em L3, de acordo com valores previamente definidos na literartura. Verificámos uma prevalência de Sarcopénia de 40.7% em doentes submetidos a gastrectomia. A Sarcopénia relacionou-se com uma mortalidade global mais elevada. O Risco Nutricional e a percentagem de peso perdido não identificaram os doentes sarcopénicos. 51.4% dos doentes sarcopénicos tinham excesso de peso, 2.9% eram obesos. Aos 12 meses após gastrectomia, 82.1% dos doentes tinham diminuído de peso e IMC e 79.6% dos doentes tinham perdido massa muscular. Não encontrámos uma associação significativa entre a modificação na massa muscular e no peso ou IMC. Verificámos que a gastrectomia total se associava a uma perda de massa muscular significativamente superior à da gastrectomia subtotal. Verificámos que estadio avançado da neoplasia gástrica se associava a uma maior perda de massa muscular. Concluímos que a prevalência de Sarcopénia em doentes com cancro gástrico é elevada e que, após gastrectomia, a maior parte desses doentes perde peso e massa muscular. Dado que a maioria dos doentes não irão aumentar a sua massa muscular no pós-operatório, é crucial implementar estratégias de pré-habilitação precocemente.

Palavras-chave: *Sarcopenia, Índice Muscular L3, Gastrectomia, Cancro Gástrico, Nutrição.*

INTRODUCTION

Sarcopenia is defined as the loss of skeletal muscle mass. The term was first introduced by Rosenberg[1] in 1989 to describe the age-related loss of muscle mass as part of a discussion on the physical status of the elderly, namely the difference between biologic and chronological age.

In 2010 the European Working Group on Sarcopenia in Older People (EWGSOP) first published the European Consensus on Definition and Diagnosis of Sarcopenia[2]. The 2010 definition introduced the concepts of sarcopenic obesity (loss of muscle mass with no decrease in fat mass) in cancer patients and the phenomenon of muscle marbling (fat infiltration of the muscle) as a condition that resulted in lower muscle quality and performance.

In 2018 the EWGSOP group shifted the focus to loss of muscle strength as the identifier of probable sarcopenia, which was then to be confirmed by the presence of low muscle mass or quality[3].

Considering the association of weight loss and nutritional risk in patients with gastric cancer, these patients were deemed at a particularly high risk of muscle depletion and much research was done on the prevalence and impact of sarcopenia among gastric cancer patients[4-22].

Interestingly, while much has been said on the prevalence and effect of preoperative Sarcopenia, there is little information on the effects of gastrectomy on body composition and the postoperative prevalence of Sarcopenia. Gastrectomy may reduce food intake, lead to increased protein catabolism, insulin resistance, and metabolic changes which in turn may lead to weight loss and hypothetically to a higher prevalence of sarcopenia[3,23].

The aims of this paper were to determine the prevalence of sarcopenia assessed by CT scan (Cross Sectional Muscle Area at the L3 level) among patients undergoing gastrectomy for gastric cancer, to assess the impact of sarcopenia on the post-operative course and overall survival and to assess the changes in body composition after gastrectomy.

METHODS

Patient Selection and Study Design

All patients undergoing surgery for gastric cancer from January 2015 to May 2020 at our institution were reviewed. This was a retrospective cohort study of a prospectively built database. Only patients who had underwent a gastrectomy (total/subtotal) and had a pre-operative CT scan performed at our institution were included. A subgroup analysis was then performed of all the patients who had a

CT scan performed at our institution 12 months postoperatively.

Outcomes and covariates

Patient characteristics (including age, sex, weight, height, BMI, percentage of body weight lost, Nutrition Risk Screening 2012, comorbidities, ASA score), tumour stage (American Joint Committee on Cancer TNM staging and histology – 8th Edition), treatment characteristics (type of gastrectomy, chemotherapy regimen (adjuvant or neoadjuvant) were collected from the electronic medical record. Post-operative complications, hospital length of stay (LOS), and overall survival were the primary outcomes. Impact of comorbidities was stratified by the Charlson Comorbidity Index. Surgical complications were classified by the Clavien-Dindo Classification of Surgical Complications Scale. For the sub-group analysis, weight and BMI 12 months postoperatively were also collected.

Imaging studies and analysis

All included patients underwent CT scan of the abdomen and pelvis as part of the preoperative work-up. For the subgroup analysis, CT scans performed at 12 months post-operatively as part of the follow-up protocol were considered.

The CT scans were analyzed with the Osirix software by two radiologists.

Two consecutive axial images at the L3 level (with both transverse processes visible) were processed.

Skeletal muscle interest areas were selected using the –30 to +110 Hounsfield Units interval.

The automatic selections were manually corrected.

The total cross-sectional area (CSA) was automatically calculated for the two consecutive images and the average among the CSA of the two images was obtained. This final Cross-Sectional Area (cm^2) was then adjusted to the squared height of the patient thereby yielding the L3 Muscle Index (cm^2/m^2).

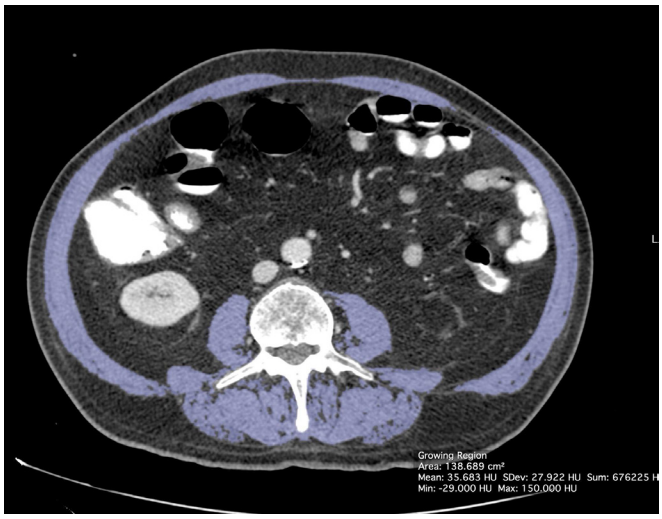

FIGURE 1 – **Corrected Skeletal Muscle Area at the L3 level**

Patients were considered Sarcopenic if the L3 Muscle Index[21] was:

- lower than 43 cm^2/m^2 in men with a BMI < 25;
- lower than 53 cm^2/m^2 in men with a BMI > 25;
- lower than 41 cm^2/m^2 in women.

Statistical analysis

Continuous variables are presented as median (minimum and maximum) and categorical variables as frequencies and percentages. Chi-squared or Fisher's exact tests were used to evaluate the association between two categorical variables. Comparisons between groups were performed using Mann–Whitney tests for continuous variables.

Overall survival was estimated by the Kaplan-Meier method. The log-rank test was performed to compare survival rates between groups. Risk factors were tested using a Cox-regression model. Hazard ratios (HRs) were calculated with 95% confidence intervals.

Statistical significance was considered at the level of $p < 0.05$. All statistical analysis was performed using the software R v4.0.1.

RESULTS

Sarcopenia in Gastric Cancer Patients undergoing Gastrectomy

A total of 86 patients were included in this study. The majority of patients were male (n=64, 74.4%) and median age was 71.5 (32-85) years old (Table 1). Median follow-up time was 24.8 months. On preoperative assessment we found a prevalence of Sarcopenia of 40.7%.

There were no significant differences in age, gender, percentage of weight lost, nutritional risk, ASA score, Charlson comorbidity score or cancer stage between sarcopenic and non-sarcopenic patients.

Table 1 – **Patient Characteristics**

Characteristics	Total (n=86)	Sarcopenia		
		No (n=51)	Yes (n=35)	p-value
Age	71.5 (32.0-85.0)	70.0 (42.0-85.0)	72.0 (32.0-83.0)	0.722
Gender				
Male	64 (74.4%)	36 (70.6%)	28 (80.0%)	0.465
Female	22 (25.6%)	15 (29.4%)	7 (20.0%)	
BMI				
Underweight	6 (7.0%)	0 (0.0%)	6 (17.1%)	**<0.001**
Normal Weight	37 (43.0%)	27 (52.9%)	10 (28.6%)	
Overweight	32 (37.2%)	14 (27.5%)	18 (51.4%)	
Obese	11 (12.8%)	10 (19.6%)	1 (2.9%)	
Weight Loss	5.5 (0.0-27.2)	5.7 (0.0-23.1)	4.9 (0.0-27.2)	0.703
Unknown	8 (9.3%)	5 (9.8%)	3 (8.6%)	
Nutrition Risk Screening				
Low Risk	47 (54.7%)	25 (49.0%)	22 (62.9%)	0.510
At Risk	13 (15.1%)	9 (17.6%)	4 (11.4%)	
High Risk	14 (16.3%)	9 (17.6%)	5 (14.3%)	
Unknown	12 (14.0%)	8 (15.7%)	4 (11.4%)	
ASA				
1	6 (7.0%)	3 (5.9%)	3 (8.6%)	0.971
2	38 (44.2%)	23 (45.1%)	15 (42.9%)	
3	37 (43.0%)	22 (43.1%)	15 (42.9%)	
4	5 (5.8%)	3 (5.9%)	2 (5.7%)	
Charlson	4 (1-9)	4 (1-9)	4 (1-8)	0.798
Stage				
I/II	45 (52.3%)	25 (49.0%)	20 (57.1%)	0.602
III/IV	41 (47.7%)	26 (51.0%)	15 (42.9%)	
Hospital Stay	10 (6-122)	10 (7-82)	10 (6-122)	0.747
Clavien-Dindo				
None/minor complications (≤ 2)	61 (70.9%)	35 (68.6%)	26 (74.3%)	0.744
Major complications (≥ 3)	25 (29.1%)	16 (31.4%)	9 (25.7%)	

There were significant differences in BMI between sarcopenic and non-sarcopenic patients (p<0.001; Fig. 2). Non-sarcopenic patients, were mostly normal weight (52.9%), 27.5% were overweight and 19.6% were obese. Most sarcopenic patients were overweight (51.4%), 28.6% were normal weight, 17.1% were underweight and only 2.9% were obese.

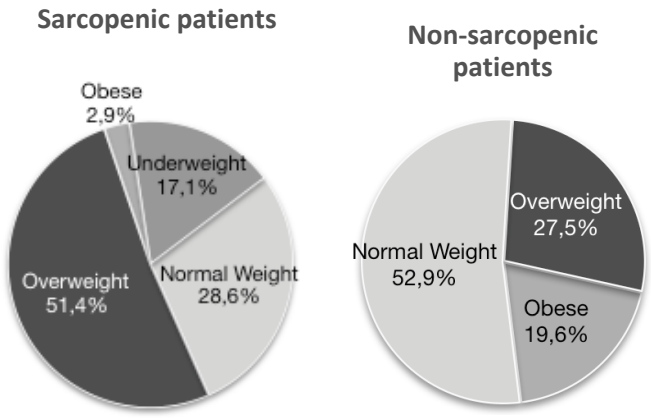

FIGURE 2 – **BMI distribution among sarcopenic and non-sarcopenic patients (p<0.001)**

Sarcopenia was not associated with the occurrence of post-operative complications or a longer length of stay.

Sarcopenic patients had a worse overall survival than non-sarcopenic patients as shown by the Kaplan-Meyer (p=0.046; Fig. 3)

A Cox regression model showed a Hazard Ratio of 2.08 (95% CI: 1.01-4.32), showing that Sarcopenia was a risk factor for mortality. Sarcopenic patients are twice as likely to die than non-sarcopenic patients.

Body Composition changes after gastrectomy

For the subgroup analysis, 39 patients were included.

At 12 months post-operatively, 82.1% (n=32) of patients lost weight, 12.8% (n=5) gained weight and 5.1% (n=2) had no change in weight. The median difference in weight was –6Kg. The changes in BMI mirrored the weight changes, the median difference

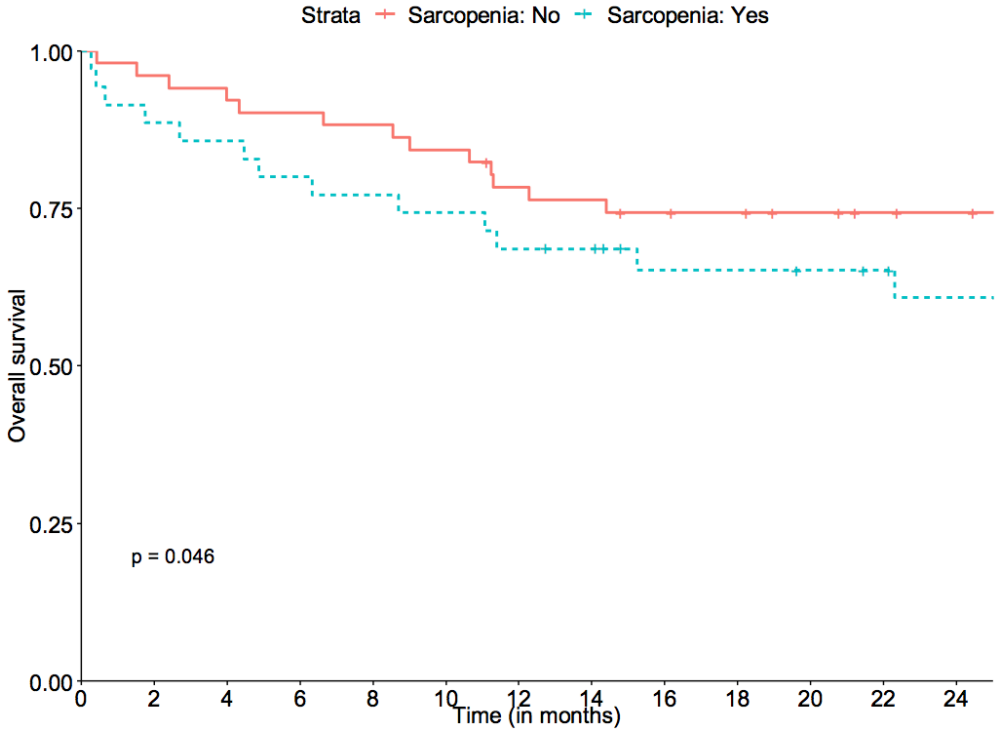

FIGURE 3 – **Overall survival in sarcopenic vs non-sarcopenic patients (p=0.046).**

in BMI was –2.3 Kg/m^2. The median difference in Cross Sectional Area was –10.1cm^2 and the median difference in L3 Muscle index was: –3.6cm^2/m^2. After their gastrectomy, 76.9% (n=30) patients lost muscle mass (as measured by the L3 muscle index).

Fourteen patients (35.9%) were sarcopenic pre-operatively and 16 patients (41%) were sarcopenic post-operatively. After considering the BMI-dependent cut-off values, we found that 7 patients "became" sarcopenic after gastrectomy: all of them had lost muscle mass, 6 of them had also lost weight, had 1 gained weight. Five patients became non-sarcopenic: while 4 increased their muscle mass, only one had gained weight. We did not find a significant association between the change in muscle mass and the change in BMI or weight.

Table 2 shows the changes in weight and muscle mass according the pre-operative BMI. The patients who became non-sarcopenic were either normal weight or overweight pre-operatively. All obese patients lost weight and muscle mass after gastrectomy, all lowered their BMI to overweight and some became sarcopenic, none improved their muscle mass. Despite some changes in weight and muscle mass no underweight patients were able to reach a normal weight or muscle mass.

There was a significant association between the muscle mass change and the type of surgery:

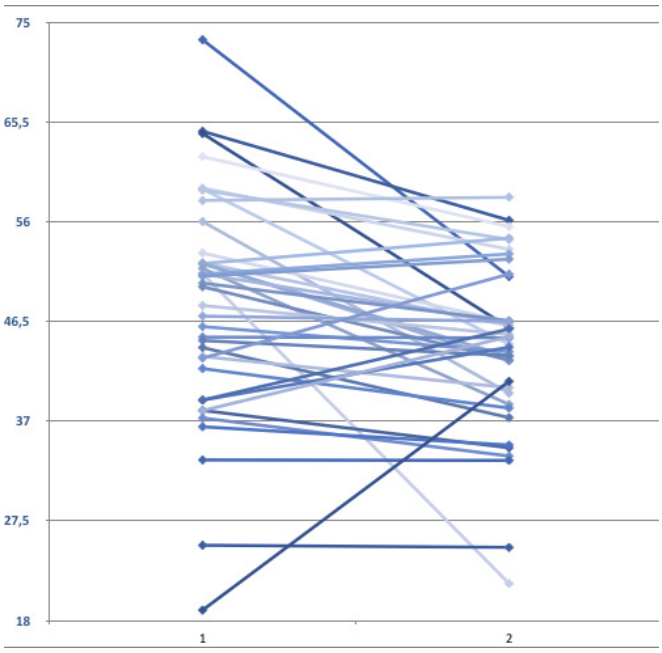

Figure 4 – **Changes in Muscle Mass – On the left (1) are the pre-operative values of the L3 Muscle Index, on the right (2) are the values of the L3 Muscle Index after gastrectomy.**

Table 2 – **Distribution of Body Composition type before and after Gastrectomy. 0 = no change**

Pre-Op Body Composition	n	CHANGE	Post-Op Body Composition
Underweight sarcopenic (n=3)	3	0	Underweight sarcopenic
Normal weight, sarcopenic (n=4)	2	↓ weight	Underweight sarcopenic
	2	↑ **muscle**	Normal weight, non sarcopenic
Normal weight, non sarcopenic (n=13)	1	↓ weight ↓ muscle	Underweight sarcopenic
	3	↓ muscle	Normal weight, sarcopenic
	9	0	Normal weight, non sarcopenic
Overweight sarcopenic (n=6)	3	↓ weight	Normal weight, sarcopenic
	3	↓ weight, ↑ **muscle**	Normal weight, non sarcopenic
Overweight, non sarcopenic (n=7)	1	↓ weight ↓ muscle	Normal weight, sarcopenic
	4	↓ weight	Normal weight, non sarcopenic
	2	0	Overweight, non sarcopenic
Obese sarcopenic (n=1)	1	↓ weight	Overweight sarcopenic
Obese, non sarcopenic (n=5)	3	↓ weight	Overweight, non sarcopenic
	2	↓ weight ↓ muscle	Overweight sarcopenia

total gastrectomy was significantly associated to muscle mass loss compared to subtotal gastrectomy (p=0.014). 88.9% of the patients submitted to a total gastrectomy had loss of muscle mass (lower L3 Muscle Index) at the 12-month evaluation, whereas only 50% of subtotal gastrectomy patients lost muscle mass. Changes in weight and BMI were not associated with the type of gastrectomy (total vs subtotal, p=0.307, p=0.028).

We found a significant association between advanced gastric cancer stage and muscle mass loss post-operatively (p=0.033): all patients with advanced gastric cancer (stages III and IV) suffered muscle mass loss as per the L3 Muscle Index.

Adjuvant chemotherapy was not associated with loss of muscle mass or weight loss.

DISCUSSION

Assessing muscle mass in Gastric Cancer and the impact of Sarcopenia

Rosenberg[1] (1989) argued that loss of muscle mass and function were of dramatic relevance to the fitness of the elderly, as it affected their ability to walk, breathe, their independence and nutritional intake. Rosenberg also pointed out a relationship between exercise and muscle loss and that there should be a focus on finding out how to rebuild muscle mass and recover function in elderly patients – the goal of the prehabilitation programs.

In the EWGSOP consensus (2010), for definition of Sarcopenia[2], both low muscle mass and loss of strength or performance were required to establish a diagnosis, as muscle strength does not depend on, or is related exclusively to muscle mass.

After the publication of this definition, many authors studied the prevalence and impact of Sarcopenia in various diseases and conditions. Sarcopenia was defined, in many of these studies, as low muscle mass on CT scans, as is the case of this report.[21, 24-26]

In the EWGSOP2 (2018) muscle strength was brought to the forefront[3], as it seems to be a better predictor of frailty and decline in primary sarcopenia[27,28] (whether this applies to prognosis of secondary sarcopenia is not yet clear). Besides, physical performance (muscle strength) is technically easier to assess in the clinical setting (SARC-F questionnaire, Grip strength and Chair Stand Test) and in cases of suspicion of sarcopenia, it should be confirmed by measurement of muscle quality and/or muscle mass.

As muscle mass is correlated to body size, the muscle mass estimated by the above-mentioned techniques should be adjusted to body size. This adjustement can be done using the squared height, squared weight ou BMI. Dernestine et al[29] have worked on the thresholds for Sarcopenia and how they correlate with height and weight but not BMI, their results suggest that the skeletal muscle index, used to identify sarcopenia, should be adjusted for BMI. There is currently no consensus on which adjustment is better or whether a particular adjustment is better suited to a specific population. There is not a consensus either on whether total body skeletal muscle mass, appendicular skeletal muscle mass or cross sectional areas have the same accuracy and meaning[3].

CT scans are accurate in distinguishing body composition and provide consistent measures with little observer or machine variation. They allow assessment of muscle mass of specific muscles or body areas and the results are consistent even in individuals with low muscle mass and high weight.[30,31] CT scans can provide various parameters such as muscle mass at the L3 level, mid-thigh muscle mass or psoas muscle mass. As most patients with gastrointestinal cancer undergo CT scans of the abdomen and pelvis, the L3 muscle mass has been extensively tested in these patient populations.

We have studied muscle mass and body composition using CT scans due to its high accuracy (even in underweight patients) and high availability of this information as all our patients undergo

preoperative and follow-up CT imaging. We also opted to use the L3 Muscle Index over the Psoas Muscle Index as it has been more thoroughly used in the literature.

In our study we opted for the cut-off values by Martin et al[21], which have often been used in the literature and include different thresholds to account for BMI.[5,10,15, 29, 32-37]

Muscle quality is a more recent parameter than muscle mass. It translates the changes in muscle composition (fat infiltration) associated with a worse muscle function.

This assessment may be done by MRI or CT and the two techniques are equally feasible and seem to be interchangeable[37]. Muscle quality has been shown to have a prognostic relevance in gastro-intestinal surgery[38-40] but there is still no consensus on assessment methods and clinical aplicability[3].

The impact of sarcopenia among gastric cancer patients (Table 1), submitted to gastrectomy in our department, was the focus of this work.

A 2020 meta-analysis of 15 studies[4] (including a total of 4887 patients) on sarcopenia among gastric cancer patients, concluded that sarcopenic patients had a higher probability of post-operative complications (namely severe complications) and a higher overall and disease-specific mortality. However, Borggreve et al[4] noted that the methods and cut-off values used to define Sarcopenia were remarkably variable among the various studies.[5,6,8,10-20,41]

We found a prevalence of sarcopenia (assessed by CT scan) of 40.7% among gastric cancer patients undergoing gastrectomy. The prevalence of sarcopenia in preoperative gastric cancer ranges between 7% and 70% according to the patient population and the methods used to assess sarcopenia[42]. A previous study[35], on Portuguese gastric cancer patients undergoing chemotherapy, found a prevalence of sarcopenia of 23%. A Spanish study[43] reported a prevalence of sarcopenia, among gastric cancer patients, of 45.4%, quite similar to ours.

While we did not find an association between postoperative complications and sarcopenia, we did find that sarcopenia was associated with a higher overall mortality.

It should also be noted that percentage of body weight lost and nutritional risk screening were not associated with sarcopenia. These parameters did not identify sarcopenic patients and do not seem to translate the risk of muscle depletion.

The EWGSOP[3] also put a focus on sarcopenic obesity. This condition refers to the coexistence of muscle mass depletion (sarcopenia) and obesity. Diagnosis using CT scan in cancer patients was first introduced by Martin et al[21] and this study is credited with establishing that loss of muscle (not loss of fat) portended a worse prognosis in these patients. In our study, sarcopenic obesity was only 2.9% of sarcopenic patients, however 51.4% of sarcopenic patients were overweight. We once again proved that sarcopenia can be present even with an excessive body weight and these overweight (sarcopenic) patients do have a higher risk than non-sarcopenic patients.

Body Composition Changes after Gastrectomy

Only a few reports have been published on sarcopenia before and after gastric cancer treatment.

Kouzo et al[23] studied 67 patients with recurrence after gastrectomy for gastric cancer. They found that a high reduction rate of the Psoas Muscle Index (PMI), between the preoperative and the "recurrence" PMI, was independently associated with a poor prognosis after recurrence. The L3 Muscle Index was not used in this study. It is worth mentioning that one of the findings of the study by Kouzo et al[23] was that a failure to complete more than 5 sessions of chemotherapy was also associated with a worse prognosis after recurrence.

In our study, we looked at body composition changes at 1 year postoperatively and we found that,

at 12 months post-operatively, 82.1% of patients lost weight, 12.8% gained weight and 5.1% had no change in weight (yielding a median change in weight of – 6Kg). The exact same pattern applied to the BMI after gastrectomy.

We also found that 76.9% of patients lost muscle mass (decreased their L3 muscle index) after gastrectomy. We did not find a significant association between the change in muscle mass, BMI or weight: as expected, muscle mass changes seem to be a phenomenon independent of BMI and weight.

After gastrectomy some patients "became" sarcopenic (most of whom had lost weight), a few however actually increased their muscle mass postoperatively and became non-sarcopenic. This increase in muscle mass was not followed by weight gain in most patients and we did not find a significant association between the change in muscle mass and the change in BMI or weight. The patients who increased their L3 muscle mass index postoperatively were mostly early stages gastric cancer patients who had undergone a subtotal gastrectomy. Accordingly, we found a significant association between the muscle mass change and the type of surgery: total gastrectomy was significantly associated to muscle mass loss compared to subtotal gastrectomy. We also found a significant association between advanced gastric cancer stage and muscle mass loss.

The patients who became non-sarcopenic post-operatively were either normal-weight or overweight pre-operatively. None of the pre-operatively obese patients improved their muscle mass. So, despite apparently adequate nutritional intake, obese patients do not improve muscle mass post-operatively. We do not know whether this is due to previous deleterious eating habits, sedentary lifestyle or inadequate physical activity, or whether this may translate the effect of adipose tissue on anabolic and catabolic metabolism. Despite some changes in weight and muscle mass, no underweight patients were able to reach a normal weight or muscle mass. Pre-operative interventions on these patients seem mandatory.

Takahashi et al[44] studied post-operative muscle mass among elderly patients undergoing distal gastrectomy. They found that patients lowered weight, muscle strength, muscle performance and appendicular muscle mass (BIA assessed) in the first six months postoperatively. But while weight and visceral fat area increased by 1 year postoperatively, the appendicular skeletal muscle mass index did not. Actually, the frequency of sarcopenia remained almost unchanged at 1 year postoperatively. Their analysis, however, was limited to elderly, stage I gastric cancer patients, submitted to a Bilroth-II type of reconstruction and who did not undergo adjuvant chemotherapy. Our results report on a much wider gastric cancer population undergoing both total and subtotal gastrectomy, with Roux-en-Y type of reconstruction, with and without adjuvant chemotherapy.

Lee et al[45] studied 247 patients submitted to gastric ressection and similarly they found that patients undergoing total gastrectomy suffered bigger reductions in hemoglobin, nutritional parameters, visceral fat and abdominal muscle mass.

Kugimiya et al[46] analysed the skeletal muscle mass at 6 months post-operatively of 119 patients and found that total gastrectomy was risk factor for a higher decrease in muscle mass. Their study also suggested that a loss in skeletal muscle mass ≥5% (6 months post-operatively) was a risk factor for a shorter overall survival.

Park et al[47] (2020) had studied the L3 Skeletal Muscle Index of patients with gastric cancer before and after palliative chemotherapy. They found that sarcopenia at baseline was associated with a worse prognosis and that a greater decrease in skeletal muscle mass after chemotherapy portended a worse outcome with a shorter overall survival.

Other authors[35,48] had already shown a negative association between sarcopenia and chemotherapy tolerance.

Thanks to these contributions, it seems increasingly clear that sarcopenic patients have a worse prognosis and this seems to be true for any step of

the way in gastric cancer treatment (pre and post-operatively, and before and after chemotherapy).

We do not yet know what determined the increase in muscle mass that we found in a few patients, whether their nutrition intake was improved or whether the increase in muscle mass is due to improved post-operative fitness and activity.

However, it should be noted that the vast majority of patients did not manage to improve their muscle mass after gastrectomy. Our study therefore suggests that interventions to improve patients muscle mass pre and post-operatively are necessary as patients do not easily overcome their low muscle mass alone. Nutritional management[49,50] (optimal calorie and protein intake) and skeletal muscle mass loss prevention[51] (physical activity) have been shown to decrease muscle depletion both pre- and post-operatively. The relevance of prompt identification of sarcopenia goes beyond adequate pre-operative risk stratification to actually enabling timely inclusion of these patients in prehabilitation programs, any time throughout the treatment process, thereby improving prognosis[52].

Limitations

This study has a few limitations, it was a retrospective study, the sample for the subgroup analysis is relatively small. Likewise, the mean follow-up time is relatively short due to a number of patients included with little follow-up time. Increasing the number of patients in the subgroup analysis and their follow-up time would allow to properly study the long-term impact of postoperative sarcopenia and other categories of body composition.

CONCLUSION

Sarcopenia is highly prevalent among gastric cancer patients undergoing gastrectomy. Pre-operative sarcopenia is associated with a worse overall survival.

After gastrectomy, the vast majority of patients lose weight and muscle mass. Total gastrectomy and advanced stage gastric cancer were associated with a higher muscle mass loss. Sarcopenic patients are not to likely to improve muscle mass after gastrectomy. These patients would particularly benefit from pre-operative and post-operative interventions aimed at improving their nutritional status and fitness.

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Ethics approval

The Ethics Board at our institution approved this study (86/2020)

Conflict of Interest/Disclosures

None

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Correspondência:
MARGARIDA FERREIRA
e-mail: margarida.s.f@gmail.com

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