



Sarcopenia In Diabetic Patients- A Neglected Entity?

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Abstract

Background: Sarcopenia is a syndrome associated with decreased muscle mass, decreased muscle strength and decline of physical activity. Diabetics are at an increased risk of developing sarcopenia due to hyperglycemia, oxidative stress and chronic inflammation.

Materials And Methods: We have conducted a prospective observational study in randomly selected patients visiting the Medicine OPD and their demographical data, detailed co-morbid history were taken along with BMI, mid arm circumference and Hand Grip Measurements and analyzed

Results: A total of 60 patients were included out of which 30(50%) were diabetics. Sarcopenia was present in 26 of the patients out of which 18 were diabetics. The mean duration of DM was 7.5 years in sarcopenic patients ($p < 0.05$). There was also significant association between Sarcopenia and lower muscle mass ($p < 0.001$), muscle function ($p < 0.004$), HbA1c and presence of micro and macro vascular complications ($p < 0.05$).

Conclusion: Uncontrolled Diabetes, long standing diabetes are important risk factors for the development of sarcopenia and frailty which can affect the physical and psychosocial ability of the patients leading to poor quality of life. The presence of sarcopenia also indicates the presence of micro or macro vascular complications. Sarcopenia is often neglected in clinical practice and its early detection and management would reduce complications, better glycemic control and overall improved quality of life.

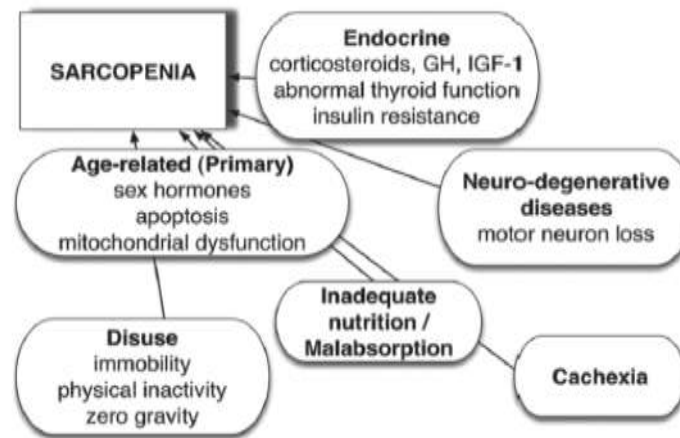
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Introduction

What Is Sarcopenia?

The term sarcopenia to the loss of muscle mass, muscle strength, or physical function.^[12] In 2010, the European Working Group on Sarcopenia in Older People developed a practical clinical definition and consensus diagnostic criteria for sarcopenia recommending to utilize the presence of both low muscle mass and low muscle function (strength or performance) [3]. In 2018, an update by the same working group was provided defining sarcopenia by low measurement levels of three parameters: muscle strength (evaluated by hand grip strength), muscle quantity/quality (evaluated by appendicular lean mass or skeletal muscle mass), and physical performance (evaluated by gait speed or short physical performance battery) as an indicator of severity.

Fig.1: Various mechanisms of sarcopenia



[Adapted from : Kim TN, Choi KM . Sarcopenia: Definition, Epidemiology, and Pathophysiology[4]]

What is the problem with sarcopenia?^[4]

The Clinical consequences are significant because it increases the risk of functional limitations, disability and morbidity. Reduction in resting metabolic activity and physical activity can lead to increased fat mass particularly visceral fat (sarcopenic obesity). Sarcopenia and obesity inturn have an additive effect on the inflammatory process and increases the risk of complications. Frailty, increased risk of fractures and mortality

There are many studies which are published showing that there is an increased risk in patients of type 2 diabetes mellitus to develop sarcopenia. The probable mechanism is that changes of the muscular fibers in participants with T2DM may due to diabetic complications and insulin resistance which is oxidative type I muscular fibers are reduced and glycolytic type II fibers increased,^[6] which accelerate the declination of muscle mass and strength. Furthermore, sustained hyperglycemia increases the accumulation of advanced glycation end products (AGEs) in the muscles and cartilage, which in return leads to muscle stiffness and reduced muscle function.^{[6][7]}

However there are very few studies published from India regarding the prevalence of sarcopenia in type 2 diabetes mellitus and its implications. Hence we have conducted this study in a tertiary care center of Bangalore which received good mixture of both urban and semi-urban population.

Aims And Objectives

1. To find out the prevalence of sarcopenia in the study population
2. To establish the relationship between sarcopenia and type 2 diabetes
3. To find out the relationship between sarcopenia and complications of diabetes
4. To correlate our findings with the existing literature.

Materials And Methods

- Study setting: Manipal Hospitals, Old Airport Road, Bangalore
- Study Duration: 1st Nov,2022 to 30th Nov, 2022
- Study design: Observational Study
- Study Population: All the patients attending the General Medicine OPD during the study period.
 1. Inclusion Criteria: All the patients who are more than 18 years old, giving consent to the study.
 2. Exclusion Criteria: All the patients who did not consent for the study, known case of frailty or who are already established to have sarcopenia due to various other causes.
- Sample Size: The sample size for the study was estimated to be **60**.
- Data Collection: The patients who were included in the study were first interviewed and their demographic data was taken followed by

anthropometric measurements – height, weight, MAC and hand grip.

We measured the participants’ HGS using a medical handgrip dynamometer. Each individual sat on a chair with armrests after removing rings, watches, and other objects from their hands and wrists. Three measurements were obtained for each hand in an alternating manner, and the maximum strength was defined as the greatest of all six measurements. Weakness was defined according to the Foundation for the National Institutes of Health Sarcopenia Project (FNIH) cutoff point as a HGS < 26 kg in men and <16kg in women.

Data Analysis: Data is presented as median(IQR) and Frequency(%). Quantitative variables are tested for significance using non parametric tests Kruskal Wallis while Qualitative variables using Fischer exact test. Cochran Armitage trend test is used to explore the relationship between uncontrolled diabetes and sarcopenia. Logistic regression analysis is used to examine the association between sarcopenia and diabetic indicator using age, gender

as control variables. Level of significance is set at p<0.05.

Results

A total of 60 patients were included in the study, out of which 58% were male and 48% were female. 43% of the patients had sarcopenia out of which 18patients had diabetes. There was no significant difference in the BMI levels between the sarcopenia and non –sarcopenia group but there was significant difference between them in Mid Arm Circumference levels and Hand Grip Strength readings. Cochran Armitage trend test showed that there was significant increase in the incidence of sarcopenia as the duration of diabetes increased. Further analysis done showed there was significant increase in the incidence of micro and macrovascular complications in the sarcopenic group. Logistic Regression analysis was done to find out the various risk factors for sarcopenia and it showed Female Sex, Duration of Diabetes and Mid Arm Circumference strongly predict the risk of sarcopenia.

Table 1: Characteristics of Subjects Categorized by Sarcopenia [median(IQR) and Frequency(%)]

	Total (n=60)	Sarcopenia (n=26)	Non-Sarcopenia (n=34)	p Value
Age(yrs)	45.50(25.00)	57.50(26.00)	43.00(18.00)	0.056
Gender				
Male	35(58)	10(17)	25(42)	0.0087
Female	25(42)	16(27)	9(15)	
Duration of DM(yrs)	0.50(10.00)	7.50(20.00)	0.00(3.00)	0.001
History of Hypertension	16(27)	10(17)	6(10)	0.0851
BMI (Kg/m2)	25.00(6.60)	26.00(9.24)	24.34(5.86)	0.994
MAC	26.00(4.00)	24.00(5.00)	27.00(5.00)	<0.001
HG	19.00(16.00)	10.50(8.00)	28.00(6.00)	0.004

Table 2: Characteristics of Subjects Categorized by Diabetes [median(IQR) and Frequency(%)]

	Total (n=60)	Diabetes Group (n=30)	Non- Diabetes Group (n=30)	p Value
Age(yrs)	45.50(25.00)	60.50(23.00)	38.00(14.00)	0.000
Gender				
Male	35(58)	19(32)	16(27)	0.6010
Female	25(42)	11(18)	14(23)	
History of Hypertension	16(27)	14(23)	2(3)	0.0009
History of Thyroid disorders	4(7)	3(5)	1(2)	0.612
Sarcopenia	26(43)	18(30)	8(13)	0.0182
BMI (Kg/m2)	25.00(6.60)	60.50(23.00)	38.00(14.00)	0.790
MAC	26.00(4.00)	25.00(3.00)	27.00(5.30)	0.016
HG	19.00(16.00)	15.00(16.00)	27.00(15.00)	0.004

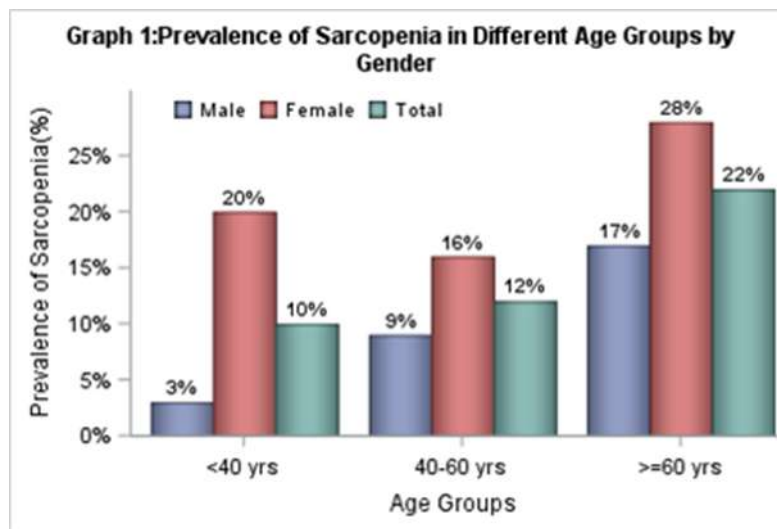


Table 4: Prevalence of Sarcopenia in Different Durations of Diabetes (percentage/range where applicable)

Duration of Diabetes (yrs)	Total (n=60)	Sarcopenia (n=26)	Non-Sarcopenia (n=34)	Between Groups p Value^	With-in-Groups p Value*	Trend Test p Value**
<=5 yrs	39(65)	10(17)	29(48)		0.0023	
5-10 yrs	5(8)	4(7)	1(2)	0.0005	0.1797	0.1342
>=10 yrs	16(27)	12(20)	4(7)		0.0455	

^Fisher Exact test, * Pearson Chi-square, ** Cochran-Armitage Trend Test

Table 5: Diabetic Related Indicators in Sarcopenia [median(IQR) and Frequency(%)]

	Total (n=60)	Sarcopenia (n=26)	Non-Sarcopenia (n=34)	p Value
Anti-diabetic drug	28(47)	17(28)	11(18)	0.0183
Exogenous Insulin	13(22)	10(17)	3(5)	0.01
Macrovascular Disease	17(28)	11(18)	6(10)	0.0462
History of Heart Disease	10(17)	7(12)	3(5)	0.0851
History of Stroke	6(10)	4(7)	2(3)	0.3882
History of PVD	7(12)	6(10)	1(2)	0.0359
Microvascular Disease	10(17)	10(17)	0(0)	<0.001
Diabetic Retinopathy	6(10)	6(10)	0(0)	0.0046
Diabetic Nephropathy	6(10)	6(10)	0(0)	0.0046
Diabetic Peripheral Neuropathy	4(7)	4(7)	0(0)	0.0307

Table 6: Logistic Regression Analysis of Risk Factors for Sarcopenia

Effect	Estimate	SE	P value	Odds Ratio	95% CI
Gender (F vs M)	0.9742	0.3524	0.0057	7.018	1.763-27.9
Duration of DM (yrs)	0.1730	0.0540	0.0014	1.189	1.070-1.32
MAC	-0.0439	0.0155	0.0048	0.957	0.928-0.98

Discussion

The risk of sarcopenia in patients with type 2 diabetes mellitus is higher and it is statistically significant. The prevalence of Sarcopenia in the study population is about 43.3% (26/60) and that in Diabetes population is about 60%. This finding is similar to the previously published literature showing increased prevalence of sarcopenia in type 2 diabetes mellitus. The risk increases with increase in age. Cui et al in their study stated similar findings.^[1]

There is significant association between duration of diabetes and control and the presence of sarcopenia. In particular, the paper by Cui et al. showed that dividing participants according to diabetes duration,

the prevalence of sarcopenia was 27.6%, 21.8%, and 52.6%, respectively in the groups with diabetes duration below 10, between 10 and 20, and above 20 years^[1]. However, other studies did not find any association between disease duration and sarcopenia^[2]. This was confirmed by the meta-analysis of Anatagostis et al. showing no difference in sarcopenia prevalence between individuals with a mean T2DM duration of ≥ 9 years or < 8.5 years [14]. However there is no proper literature of the effect of HbA1c and the development of sarcopenia and also the effect of insulin use in the pathophysiology.^[2]

The presence of Micro and Macro Vascular complications is also higher in sarcopenic patients.

Various studies done support this evidence, more often there is presence of neuropathy which might further impair the quality of life of these patients, as well as increase the social and economic burden, cognitive impairment, gait disorder, depression, and morbidity.^[2]

To conclude, there is an increased prevalence of sarcopenia in diabetic population which can be attributed to poor control, increased age and duration of the patients and also to the changing lifestyle pattern of urban population. Sarcopenics are also found to have higher incidence of micro and macro vascular complications of diabetes. It is seen that the percentage of sarcopenia is far more than the presence of complications in the population. However, during routine clinical practice there is no much emphasis given to sarcopenia as compared to the other complications. As evidenced by the pathophysiology we can also postulate that sarcopenia precedes vascular complications which has to be further studied.

Conclusion

Uncontrolled Diabetes, long standing diabetes are important risk factors for the development of sarcopenia and frailty which can affect the physical and psychosocial ability of the patients leading to poor quality of life. The presence of sarcopenia also indicates the presence of micro or macro vascular complications. Sarcopenia is often neglected in clinical practice and its early detection and management would reduce complications, better glycemic control and overall improved quality of life

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Limitations

1. Single centric study
2. Short duration of study

3. Small sample size and may not representative of the actual population
4. Hence there is a need for a large scale, multicentric study to validate our findings.

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