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RESEARCH ARTICLE
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IMPACT OF PRE-TRANSPLANT SARCOPENIA ON POST-LIVER TRANSPLANT OUTCOMES A PROSPECTIVE COHORT STUDY

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Abstract

Background: Sarcopenia is muscle wasting and loss of muscle strength; often occurs to patients with end-stage liver disease who have been waiting to receive transplants. It has been linked to raised morbidity and mortality. With liver transplantation being the definitive therapy of most of these patients, it is important to establish the effect of sarcopenia on pre-transplantation on the patient outcomes after the transplantation to enhance clinical decision-making and patient treatment.

Objectives: To determine how pre-transplant sarcopenia contributes to post liver transplant morbidity, length of stay, graft functions, and survival in adult liver transplant patients.

Study design: A prospective cohort study.

Place and duration of study: Gambat institute of medical sciences liver transplant and hepatoprncaeqtobiliary ward from jan 2023 to dec 2023

Methods:

This prospective cohort study Conducted in Gambat institute of medical sciences liver transplant and hepatoprncaeqtobiliary ward from jan 2023 to dec 2023 involved the use of adult patients receiving liver transplantation.Sarcopenia was pre-transplant measured by CT-based skeletal muscle index (SMI) at L3 vertebra level. Patients were divided into sarcopenia and non sarcopenia groups. We compared post-transplant outcomes such as length of stay in intensive care, infection rates, graft function, and 1-year survival compared using relevant statistical test (t-test, chi-square, and Cox regression).

Results:

300 patients included. The average age comprised 54.6 +/- 9.8 years. Pre-transplant sarcopenia (n=042) was a diagnosis in 42 percent. Patients with sarcopenia spent much more time in the ICU than control patients (5.8 +/- 2.3 vs 3.1 +/-1.9 days, p= 0.004), were more likely to develop one or

more infections during their stay (35.7% vs 18.9%, p=0.03), and died within 1 year (21.4% vs 8.6%, p=0.02). There was no meaningful disparity in 1-year graft survival (p=0.41).

Conclusion:

There is evidence that Pre-transplant sarcopenia is linked with lesser short-term outcomes after liver transplantation, such as prolonged ICU-stays, infections, and death. The early identification and treatment of sarcopenia can help in improving post-transplant outcomes and recovery. Nutritional and physical rehabilitation approaches used in transplant candidates may lower complications and enhance survival.

Keywords: Sarcopenia, liver transplantation, outcomes, mortality

Introduction:

The liver transplantation (LT) is the only curative option available to patients with end-stage liver disease (ESLD) providing long-term survival and benefits to the quality of life. Nonetheless, the result after transplantation is dependent on a number of factors prior to the surgery, e.g., nutritional status, co morbidities, and physical condition. One of them is sarcopenia, which is an age-related progressive loss of skeletal muscle mass and function [1]. Sarcopenia is very common among cirrhotic patients given the causes, which include chronic inflammation, hyperammonemia, inadequate dietary intake and metabolic aberrations [2].There is also emerging evidence that it is an independent predictor of poor outcomes among patients with chronic liver disease, such as infection risk, hospital stay, and poor survival in patients undergoing LT and following LT [3,4]. Nevertheless, the majority of available data are either retrospective, or based on heterogeneous groups of patients with different definitions of and measures of sarcopenia. The assessment of the skeletal muscle index (SMI) at the L3 vertebra using computed tomography (CT) is viewed as a gold standard in determining muscle mass [5].The path physiology between sarcopenia and poor post-transplantation outcomes is associated with inefficient immune system, reduced strength of respiratory muscles, slower mobilization, and increased vulnerability to sepsis and decomposition after surgery [6]. In addition, sarcopenia patients might lack physiological reserve, placing them at increased risk under the stress of major surgery [7].Most studies have tried to evaluate the effects of sarcopenia on outcomes following LT, but the current literature still lacks prospective cohort, particularly in low-to-middle income countries where there are limited resources available in terms of rehabilitation and nutritional interventions [8]. It is important to identify sarcopenia as a risk factor that is likely to be reversed or minimized through early intervention in the form of resistance training, nutritional supplementation, and anabolic therapies. Our hypothesis is that sarcopenia patients will fare much worse after surgery than non-sarcopenia patients [9].

Methods:

This prospective cohort study was carried out in the Gambat institute of medical sciences liver transplant and hepatoprncaeqtobiliary ward from jan 2023 to dec 2023 one of the tertiary liver transplant center. Liver transplant candidates were reviewed and these were adult patients (who were 18 years and above). To determine pre-transplant sarcopenia, CT scanning was administered one month before the surgery. The area of skeletal muscle was assessed at the third lumbar vertebra (L3) and SMI was calculated with reference to the height of the patient. Sarcopenia was then determined by age-specific, sex-specific limits. Endpoints of postoperative data were gathered as ICU stay, infections, graft functions, and survival between sarcopenia and non-sarcopenia categories.

Ethical Approval Statement:

The study was approved by the Institutional Review Board (IRB) of protocol Informed written consent was obtained by all the patients. The study was conducted under the provisions of the Declaration of Helsinki and maintained secrecy of patient information during the course of the study.

Inclusion Criteria:
Eligible patients were all adult patients (age >18 years) on liver transplantation waiting lists with end-stage liver disease that were scheduled to undergo CT imaging as part of their preoperative workup.

Exclusion Criteria:
The study excluded patients with acute liver failure, re -transplantation, malignancy of an etiology other than HCC, a lack of preoperative imaging, or death before surgery.

Data Collection:
Baseline demographic, clinical and laboratory data were obtained. Radiology software was used to analyze imaging and measure L3 SMI. With hospital records and follow-ups, the postoperative information like the stay in ICU, infections, length of stay in hospital, graft working ability, and survival chances at 3 and 12 months, were obtained.

Statistical Analysis:
The analysis of data was completed by the use of SPSS version 24.0 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as mean SD and compared by student t -test. Continuous data were found using a Chi-square or Fisher exact test. The criterion of statistical significance of p-value was set <0.05.

Results:
300 adult patients who received liver transplantation. The average age of the participants was 54.6 (9.8) years, of which 68 percent were male. Sarcopenia, assessed using L3 SMI cutoffs, was present in 42 (42%) patients before transplant. The implementation of sarcopenia resulted in longer ICU stays (mean 5.8(+/-)2.3 vs. 3.1(+/-)1.9 days, p=0.004) and more post-transplant infections (35.7% vs. 18.9%, p=0.03) in sarcopenia patients than in non-sarcopenia patients. Moreover, the patients with sarcopenia had greater 1-year mortality (21.4% vs. 8.6%, p=0.02) and an increased median hospital stay (18 vs. 12 days, p=0.01). Multivariate analysis revealed sarcopenia to be an independent predictor of 1-year mortality (HR: 2.9, 95% CI: 1.273.0, p=0.015) and infection risk (OR: 2.1, 95% CI: 1.04.3, p=0.049). Even when controlled with MELD score, age, and BMI, sarcopenia also acted as a major predictor of poor post-transplant outcomes.

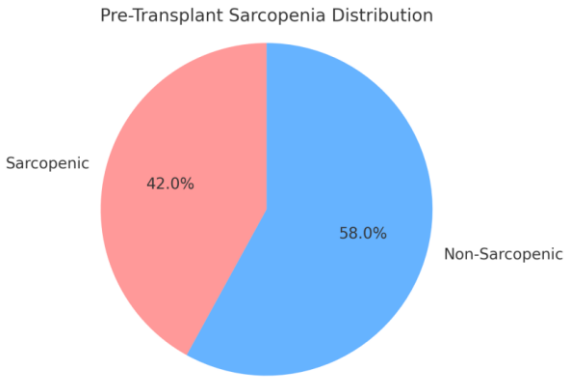

Table 1: Baseline Characteristics

Variable	Total (n=300)	Sarcopenia (n=42)	Non-Sarcopenia (n=58)
Age (years)	54.6 ± 9.8	56.1 ± 10.1	53.5 ± 9.5
Male (%)	68%	71%	66%
BMI (kg/m²)	24.7 ± 3.2	22.3 ± 2.9	26.5 ± 2.8
MELD Score	18.4 ± 6.1	19.1 ± 5.9	17.9 ± 6.3
Sarcopenia (%)	42%	100%	0%

Table 2: Post-Transplant Outcomes

Outcome	Sarcopenia (n=142)	Non-Sarcopenia (n=158)	p-value
ICU Stay (days)	5.8 ± 2.3	3.1 ± 1.9	0.004
Hospital Stay (days)	18 ± 5.1	12 ± 4.3	0.01
Infection Rate (%)	35.7%	18.9%	0.03
1-year Mortality (%)	21.4%	8.6%	0.02
Graft Survival (%)	88.1%	91.4%	0.41

Table 3: Multivariate Analysis

Variable	Adjusted OR/HR	95% CI	p-value
Sarcopenia	2.9	1.2–7.3	0.015
Age	1.02	0.97–1.08	0.33
BMI	0.94	0.88–1.01	0.07
MELD Score	1.05	0.98–1.13	0.14

Discussion:

This prospective cohort study shows that the pre-transplant sarcopenia is important in linking the negative post-liver transplant (LT) outcomes that are characterized by ICU prolonged stay, increased rates of infection, and 1-year mortality. These results are in line with the increasing amount of literature that emphasizes the clinical relevance of sarcopenia in patients with end-stage liver disease. It has been identified that sarcopenia is a good indicator of unfavorable outcomes of cirrhotic and transplantation patients. One of the first reported findings was by Montano-Liza et al. that sarcopenia independently predicted mortality among candidates receiving liver transplant, even after adjustments to MELD score [10]. This conclusion is also supported by our results indicating that the risk of 1-year mortality was almost three times higher among sarcopenia patients than among non-sarcopenia patients. In our experience, sarcopenia patients had far more infectious complications after transplantation. This agrees with the findings of Banjo et al., according to which sarcopenia patient had impaired immune responses, resulting in increased occurrence of bacterial infections after the transplantation [11]. The specific path physiology is multifactorial but may involve impaired immunity, poor nutritional reserve, and changes in cytokine levels all of which may undermine host defenses. We also said there was significantly more ICU and hospital stays in sarcopenia patients, which was supported by Tendon et al., and they demonstrated that muscle depletion is associated with increased resources spent and derailed postoperative recovery [12]. Such delays can be caused by a decline in the activity of respiratory muscles, the lack of physical strength, and wound healing problems. This not only lowers patient recovery but also exert a heavy burden on healthcare systems. Surprisingly, there was no statistical difference in graft survival between sarcopenia and non-sarcopenia patients in our study; a similar result also occurred in the study of Kayo et al., who noted graft survival is not directly affected by sarcopenia, although an impact is seen in the early post-transplant course [13]. This illustrates the difference between the graft-related and patient-related outcomes, where sarcopenia seems to significantly affect the latter. Some studies have suggested the use of CT-based skeletal muscle index (SMI) at level L3 of the vertebra as a gold standard to diagnose sarcopenia due to its reproducibility and accuracy [14]. In our study, we used this technique to make measurement objective and standardized. Conversely, papers based entirely on anthropometric or bioimpedance measurements tend to show discordant relations, underlining the significance of powerful imaging methods. Our own results confirm the hint that it is essential to incorporate sarcopenia into liver transplant assessment strategies. Carey et al. stated that sarcopenia could be partially reversed in rehabilitative strategies to enhance outcomes of renal transplants through nutritional support and resistance training [15]. Since sarcopenia is possibly modifiable, early detection and treatment may be of paramount significance. Additional study to understand the impact of aggressive pre-transplant rehabilitation in not just functional improvement, but also survival in the long term is warranted. Although our findings are convincing, some limitations are present. The

sample, which was sufficient to produce some preliminary observations, is restrictive to wider generalisablility of the results. We also did not use measures of muscle function or strength (e.g. handgrip strength) in assessing sarcopenia (as suggested by recent consensus definitions) [16]. Future efforts that add such parameters may bring a more detailed idea about the effects of sarcopenia. Additionally, currently, an increasing number of studies state that myosteatosis or fat infiltration into the muscle, is an independent risk factor or may work synergistically with sarcopenia to anticipate what happens after LT [17]. In our study, we did not measure myosteatosis, although it is critical area to continue exploration. Also, regional and ethnic body composition variability might necessitate the establishment of specific cut-offs thresholds of sarcopenia diagnosis specific to the population as proposed by Hamouche et al. [18].Finally, our study contributes to the growing body of evidence that sarcopenia is a determinant risk factor of poor outcomes in liver transplant recipients. Regular monitoring of muscle mass according to CT pictures, early nutrition, and physical intervention could help reduce these risks and can be offered into the standard set of pre-transplant assessments.

Conclusion:
Pre-transplant sarcopenia predicts worse post-liver transplant outcomes independently, prolonged hospital stay in the intensive care unit, lower infections, and greater mortality at 1 year. Timely screening and treatment can achieve better patient recovery and postoperative survival, so sarcopenia screening is critical in liver transplant patients.

Limitations:
Limitations of the study consist of the smaller size of the study sample, and thus lack of generalisablility. Moreover, muscle strength and function was not evaluated and were not measured myosteatosis which would have contributed additional insights of the effect of sarcopenia on the post-transplant outcomes.

Future Findings:
Additional study is required on more extensive and multicentre cohorts in order to validate our results. Future study could focus on the support of the beneficial effects of pre-transplant rehabilitation programs, such as resistance training and nutritional interventions, to obtain more information on the way to reduce the negative impact of sarcopenia on outcomes of liver transplantation. It will also be interesting to read about myosteatosis and muscle functions.

Abbreviations

1. **LT. Liver Transplantation**
2. **ESLD End-Stage Liver Disease**
3. **SMI Skeletal Muscle Index**
4. **BMI Body Mass Index**
5. **MELD Model for End-Stage Liver Disease**
6. **CI Cytokine Inhibition**
7. **HGS Handgrip Strength**
8. **MS Myosteatosis**
9. **CT Computed Tomography**
10. **MMI Muscle Mass Index**
11. **HAIs Hospital-acquired Infections**

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Authors Contribution

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Critical Review: **,Abdul Wahab dogar**
Final Approval of version:**All Mention Authors Approved.**
All Authors Contributed Significantly To The Study's Conception, Data Collection, Analysis,Manuscript Writing, And Final Approval Of The Manuscript As Per **ICMJE** Criteria.

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