International Journal of Science and Healthcare Research
Vol.8; Issue: 1; Jan.-March 2023
Website: ijshr.com
Original Research Article *ISSN: 2455-7587*

Does Physical Frailty and Pulmonary Function Affect the Number of Hospital Stay Among Liver Cirrhosis Patients? - A Retrospective Study

Dr. Roomy Ninama[1], Dr. Harda Shah[2], Dr. Pranjal Modi[3], Dr. Bharat Tiwari[4]

[1]MPT Student (Transplantation Rehabilitation), IKDRC-ITS, College of Physiotherapy, Civil Hospital Campus, Asarwa, Ahmedabad, Gujarat, India
[2]Senior Lecturer, PhD, IKDRC-ITS, College of Physiotherapy, Civil Hospital Campus, Asarwa, Ahmedabad, Gujarat, India
[3]Vice Chancellor, Gujarat University of Transplantation Science (GUTS) and Head of The Department (HOD), Department of Urology and Abdominal Organ Transplantation Surgery-IKDRC-ITS, Ahmedabad, Gujarat, India
[4]I/C Principal and Senior lecturer, IKDRC-ITS, College of Physiotherapy, Civil Hospital Campus, Asarwa, Ahmedabad, Gujarat, India
Gujarat University of Transplantation Science (GUTS), Ahmedabad, Gujarat, India

Corresponding Author: Dr. Roomy Ninama

DOI: https://doi.org/10.52403/ijshr.20230143

ABSTRACT

Background and need of research: Cirrhosis is permanent scarring(fibrosis) of liver and its major complication is frailty, defined as deterioration in physical and physiological function. Other complications such as Ascites, Hepatopulmonary syndrome, Respiratory muscles and generalized muscle weakness cause alteration in pulmonary function which is associated with frequent hospitalization and delisting from transplantation. The main aim of this study is to evaluate physical frailty and degree of pulmonary function abnormalities among cirrhotic patient using Short physical performance battery (SPPB) and pulmonary function using forced based spirometry pulmonary test (PFT) and to determine its relation with hospitalizations in cirrhotics.

Methods: After approval from the institutional ethical committee, data of one hundred and thirty-three liver cirrhotic patients were retrieved from Physiotherapy department and Abdominal Organ Transplant between January'22-November'22. Data available like demographic and clinical parameters, severity of frailty assessed by Short Physical Performance Battery (SPPB) and Pulmonary Function Test (PFT) were evaluated. Statistical analysis was done using SPSS V.25(IBM).

Result: Out of 133 subjects, 18(8%), 8(21%), 52(39%) were severely, moderate, and mildly frail respectively. In PFT findings, 15(11%), 43(32%), 16 (12%) had mild, moderate, and severe restriction. 4-meter gait speed test was weakly correlated with number of hospital admissions ($r=0.199$, $p<0.05$). Sit to Stand test (STS) was moderately correlated with number of hospital admissions ($r=0.24$, $p<0.05$). Comparison with categories of PFT and hospital admissions was not significant (Kruskal-Walli's test, $p<0.53$).

Conclusion and Clinical Implications: SPPB (4m gait speed and Chair STS test) showed weak correlation with number of hospitalizations. However, PFT showed no correlation with number of hospitalizations. Findings of this study imply that assessment of frailty can be used to guide future rehabilitation for such patients.

Keywords: Short Physical Performance Battery, Liver cirrhosis, Pulmonary function Test, Frailty, Retrospective study.

INTRODUCTION

Cirrhosis is a degenerative disease of the liver resulting in scarring and liver failure which is associated with a multitude of

complications that directly impact quality of life and lead to significant morbidity and mortality. A major complication of cirrhosis is frailty, a state of increased vulnerability to physical stress, is defined by decreased strength, power, and diminished physiological function that leads to increased physical dependency.[1] Frailty is measurable anatomically as sarcopenia and functionally as impaired physical performance and it is an independent risk factor for mortality, transplant waitlist removal, and life-threatening transplant related complications in patients with cirrhosis.[2,3] It also increases the patient's risk of hospitalization, accidental falls and fractures, and even death . The MELD and CTP scores are disease-specific measurements that are commonly used in the care of patients with cirrhosis, however it is difficult to differentiate whether the MELD and CTP scores depends on survivors and non-survivors or between patients who were readmitted to hospital and those who were not.[4]And that may be the reason that several authors and experts have included the assessment of physical performance and functional status in the initial clinical evaluation of liver cirrhotic patients, in making good clinical decision. The performance-based measures of muscle function such as Short Physical Performance Battery (SPPB), can be conducted quickly, reliably, and economically at the bedside. Although originally developed and validated in community-dwelling populations of adults older than 65 years, these measures of muscle function predict wait-list mortality, independent of liver disease severity in chronologically younger liver transplant candidates. [5] The tools available for the evaluation of physical frailty in patients with cirrhosis included the Short Physical Performance Battery (SPPB), Liver Frailty Index (LFI) Clinical Frailty Scale (CFS). The LFI is objective but requires specialized equipment while on the other hand the SPPB is objective without the need for equipment, but like the LFI includes three tests, and therefore, requires less time to be performed than a single measure.[6]The Short Physical Performance Battery (SPPB) has emerged as one of the most calculable tools to evaluate functional capability and physical performance of the liver cirrhotic patients.[7] The benefit of SPPB assessment tool include good reliability, validity, and responsiveness as well as simplicity. In addition, the SPPB only requires 5-10 minutes to complete, so it can be integrated into patient management without excessive time consumption. Pulmonary dysfunction is a common feature in patients with long standing liver disease and up to 70% of patients with liver cirrhosis are complaining of dyspnea.[8] Limited studies have been done to evaluate relation of ventilatory function of liver cirrhotics with hospital admissions.

MATERIALS & METHODS

Our Retrospective, Observational study included data of 133 patients who came for Pulmonary Function Test (PFT) between January 2022 – November 2022. Data of all liver cirrhotic patients who came for pre-transplant physiotherapy evaluation was included, while data of other disease such as renal or abdominal surgeries or partial data and remaining data was excluded. Data of interest i.e., Clinical characteristics, information after stratification of the sample into four SPPB groups [0–3(severe), 4-6(moderate), 7-9(mild), 10-12(nil)] and PFT findings were retrieved from the computer system of physiotherapy department and data regarding MELD, Na MELD, Child Pugh score, Number of hospital admissions of the waiting list patients and status of the patients was obtained from the patients record and computer system of the hospital. The Gujarat University of Transplantation Science Institutional Ethical committee approved this study (Guts/Ec-05/Physio-10)

STATISTICAL ANALYSIS

Continuous(quantitative) variables were reported as mean (± standard deviation) or median (interquartile range) categorical

(qualitative) variables were expressed as number and percentages (%). Analysis for the categorical data (nonrandom associations for ascites, gender, current status) was performed using the fisher's exact test, and continuous data were checked for normalcy (ascites and gender). For normally distributed data, ANOVA was used to determine if there is statistically significant difference between the 3 SPPB categorial group (mild, moderate, severe for testing the variance between different variables. For Skewed data, the Kruskal Wallis test was done. Spearman's correlation test was done between SPPB and No. of hospitalization. Statistical analysis was done using SPSS V.25.

RESULT

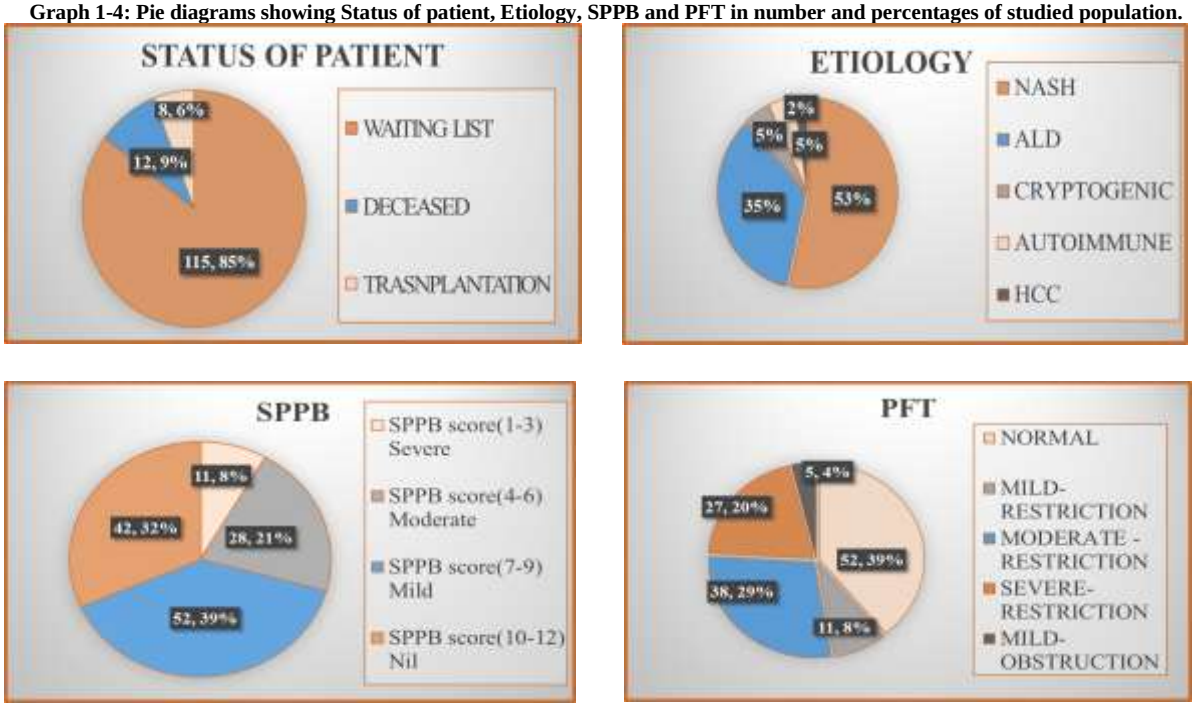
One hundred and sixty-seven cirrhotic patient's data between January 2022-November 2022 were screened. A total of 134 patients were included in the study, as shown in Figure 1. The mean age was 47.8 years (47.8± 10.1). In this study, 11 (8%) of 133 patients were females. NASH (53%) was the most common etiology of cirrhosis, followed by Alcohol (35%) and Cryptogenic and Autoimmune (5%) respectively and HCC (2%), as shown in graph 2. The baseline characteristics of the study population are described in Table-1 and graphs 1-4.

Table 1: Demographic, clinical, and laboratory data of the studied population

	Mean (SD)	Min	Max
Age	47.8± 10.1	15.0	67.0
CTP	10.8 ± 2.62	3.00	15.0
MELD	21.1± 7.02	7.00	41.0
Na MELD	22.5± 6.85	7.00	39.0
No Of Hospital Admission	1.47± 1.43	0	5.00
Duration Of Disease (Months)	27.8 ± 17.0	3.00	84.0

(CTP- Child-Turcotte-Pugh score, MELD-Model for End Stage Liver Disease)

Graph 1-4: Pie diagrams showing Status of patient, Etiology, SPPB and PFT in number and percentages of studied population.



(SPPB-Short Physical Performance Battery, PFT-Pulmonary function test, NASH- Non-Alcoholic Steatohepatitis, HCC- Hepatocellular Carcinoma)

Table 2: Comparison of Severity of SPPB with Demographic & Clinical Parameters, Number of Hospital admissions and Status of the patient.

		TOTAL SPPB 0-3 (N = 11)	TOTAL SPPB 4-6 (N = 28)	TOTAL SPPB 7-9 (N = 52)	TOTAL SPPB 10-12 (N = 42)	N	P-VALUE *P<0.05	Test
Age, Mean (Standard Deviation)		53.4 (8.24)	46.0 (7.98)	49.4 (10.2)	45.6 (11.0)	133	0.053	ANOVA
Gender(n)	**Female**	2 (18%)	3 (11%)	3 (5.8%)	3 (7.1%)	11	0.43	Fisher
	Males	9 (82%)	25 (89%)	49 (94%)	39 (93%)	122	-	-
CTP, Mean (Standard Deviation)		12.4 (2.11)	10.5 (2.27)	10.5 (2.68)	11.0 (2.78)	133	0.14	Kruskal-Wallis
MELD, Mean (Standard Deviation)		26.3 (8.16)	22.3 (7.36)	20.3 (6.60)	20.0 (6.53)	133	0.082	Kruskal-Wallis
Na+ MELD, Mean (Standard Deviation)		27.6 (7.81)	23.8 (7.02)	21.8 (6.47)	21.2 (6.41)	133	0.054	Kruskal-Wallis
Ascites (n)	**Present**	11 (100%)	22 (79%)	37 (71%)	24 (57%)	94	0.022	Fisher
	Absent	0 (0%)	6 (21%)	15 (29%)	18 (43%)	39	-	-
No Of Hospital Admission (Times) Mean (Standard Deviation)		1.73 (1.56)	1.82 (1.25)	1.48 (1.51)	1.14 (1.39)	133	0.14	Kruskal-Wallis
Duration Of Liver Disease (Months), Mean (Standard Deviation)		30.5 (18.1)	26.4 (13.0)	30.3 (20.2)	24.9 (14.5)	133	0.65	Kruskal-Wallis
Status(n)	**Waiting List**	7 (64%)	26 (93%)	47 (90%)	35 (83%)	115	0.24	Fisher
	Deceased	3 (27%)	1 (3.6%)	3 (5.8%)	4 (9.5%)	11	-	-
	Post-Transplant	1 (9.1%)	1 (3.6%)	2 (3.8%)	3 (7.1%)	7	-	-

(Table 2- p<0.05*, CTP=Child-Pugh score, MELD=Model for End Stage Liver Disease, Na+ MELD= Sodium MELD)

There was no significant difference within the category of severity of SPPB for Age, Gender and Liver parameters like CTP, MELD, Na MELD, number of hospital admission. Only ascites(p<0.022) showed significant results, as shown in Table 2.

Table 3: Correlation of Subcomponents of SPPB (Sit to stand) with No. of Hospital and Duration of disease

	Correlation coefficient	P value	Test
Sit to Stand and 4m Gait	r=0.439	p<0.001**	Spearman
Sit-stand And No. of Hospital Admission (Times)	r=0.235	p<0.01**	Spearman
Sit-stand and Duration of disease (months)	r=0.171	p<0.0491*	Spearman

(p<0.05*, p<0.001, 5-STS- Sit to Stand test, 4 Meter gait speed)**

Table 4: Correlation between 4m Gait speed (subscale of SPPB) with clinical parameters and No. Of Hospital admissions.

	Correlation coefficient	p value	Test
4m Gait and MELD	r=0.263	p<0.01**	Spearman
4m Gait and Na MELD	r=0.259	p<0.01**	Spearman
4m Gait and No. of Hospital Admission(times)	r=0.199	p<0.021*	Spearman

(p<0.05*, p<0.001, 4-Meter Gait Speed, MELD- Model for End Stage Liver Disease)**

The correlation coefficient test of subscale of SPPB; i.e., Sit to Stand Chair with 4m gait speed test, there was **moderate positive correlation** present (r=0.439, p<0.001). The correlation coefficient between Sit to Stand Chair stand with No. of hospital admissions and duration of disease, it showed **weak positive correlation** (r=0.24, r=0.171 and p<0.01, p<0.05, respectively) as shown in Table 3. The correlation of the subscale of SPPB; i.e., 4m gait speed test showed **weak positive correlation** with MELD, Na MELD and No. of Hospital admissions. (r=0.263, r=0.259, r=0.199 and p<0.01, p<0.01, p<0.021) respectively, as shown in Table 4.

Table 5: Comparison of categories of PFT with various parameters.

	Normal PFT (n = 52)	Mild Restriction (n = 11)	Moderate Restriction (n = 38)	Severe Restriction (n = 27)	Mild Obstruction (n = 5)	P value (<0.05*)	Test
AGE	48.7 (11.5)	43.6 (8.21)	47.8 (8.07)	47.3 (10.2)	51.0 (12.3)	0.32	Kruskal-Wallis
MELD	21.2 (6.67)	22.7 (6.34)	21.7 (7.12)	19.1 (7.97)	23.0 (5.96)	0.42	Kruskal-Wallis
Na MELD	22.6 (6.64)	24.5 (6.42)	23.0 (6.76)	20.4 (7.67)	24.6 (5.50)	0.26	Kruskal-Wallis
NO OF HOSPITAL ADMISSION	1.46 (1.57)	0.818 (0.874)	1.63 (1.44)	1.44 (1.37)	1.80 (1.30)	0.53	Kruskal-Wallis
TIME PERIOD (MONTHS)	25.8 (15.7)	31.6 (20.3)	27.6 (17.4)	28.1 (16.0)	39.0 (24.9)	0.66	Kruskal-Wallis

Result shows ventilatory function of 133 patients with categorization into 5 different groups. The comparison of categories of PFT with MELD, Na-MELD and Number of Hospitalization it showed not significant (Kruskal-Walli's test, $p<0.53$), shown in Table 5.

DISCUSSION

Frailty is an unstable phenomenon affecting multiple physiological systems, resulting in decreased physiological reserve and vulnerable outcomes.[1] But it could be the important criteria for prediction of outcome of the patient that was the reason this study was conducted. The objective of this analysis was to screen for frailty and pulmonary dysfunction and to evaluate its association with outcome and other variables in patients with liver cirrhosis. Factors associated with increased sarcopenia and cirrhosis include older age, increased severity of the associated liver disease, the presence of other chronic comorbidities, and longer duration of end stage liver disease [1,3]. In this study out of 133 patients, 8 patients underwent transplantation and 115 are still in the waiting list while 12 patients were deceased. As waiting list times lengthen owing to the donor organ shortage, frailty as well as liver complications has become an increasingly cited cause for mortality and morbidity. In this study, we were not able to show any significant difference within the category of severity of SPPB for age, gender and liver related parameters like CTP, MELD, Na MELD. Only ascites showed significant results within the category of severity of SPPB, shown in Table-2.

Moreover, SPPB showed no significant difference with respect to number of hospital admission with the different categories of SPPB.This might be due to small number of data which was not able to show significant results as compared to similar studies. However, when correlation of the subscale of SPPB; i.e., 4m gait speed test (sensitive tool for evaluation) was done, it showed weak positive correlation with MELD, Na MELD and No. of Hospital admissions, respectively as shown in Table-4. Josbeno and colleagues reported that the relationship of hospital days to 4m gait speed was strongly and significantly associated with the rate of hospital days per 100 days at risk and reported that, for each 0.10-m/sec reduction in walking speed, there is a 22% increase in the number of hospitalized days in frail patients with cirrhosis.[2] A gait speed of 0.88 m/s was the optimal cutoff for discrimination of patients who had greater or fewer than the mean 2.14 hospital days/100 days at risk, calculated as described by Youden, et.al.[8] In our study, the correlation coefficient test of subscale of SPPB; i.e., Sit to Stand Chair test which is a surrogate component for lower limb performance when correlated with 4m gait speed test, there was moderate positive correlation present. The correlation coefficient between Sit to Stand Chair stand with No. of hospital admissions and duration of disease, it showed weak positive correlation, respectively as shown in Table-3. Another study done by Sarah. Jones, et.al, the 5STS (Sit to stand) showed excellent

reliability, correlated with exercise capacity and lower limb strength in COPD and other chronic conditions, as STS test was strongly associated with time walking distance and mortality. [9]

However, very limited studies have been done to evaluate sit to stand (STS) test alone to predict the strength and physical function of lower limb in liver cirrhotic patients. The SPPB was found to be better at assessing physical function possibly because it involves more complex coordination and depends on a larger portion of the total body muscle mass. Although the use of SPPB is still limited in clinical settings by the perception that it requires a large space, sophisticated equipment, and training as it takes extended periods of time to implement. The SPPB takes no more than 5-10 minutes to carry out and could be applied in any clinical setting, even by non-specialized personnel, as it only requires appropriate training in its application. [10] In our study, data showed that 76 patients out of 133 showed restrictive pattern and number of hospital admission was higher in moderate to severe restriction, as shown in Table 5. Moreover, when comparison with categories of PFT and Number of Hospitalization it showed not significant (Kruskal-Walli's test, $p<0.53$). There are very limited studies regarding correlation of PFT with number of hospitalizations till now. However, the study done by Alkhayat K.F, et.al supported that pulmonary dysfunction is commonly seen in liver cirrhosis patients and is considered one of the main reasons for hospital admissions. [11]

LIMITATIONS

Nutritional assessment/dietary intake data was not taken into consideration.

Physical activity ADL and its limitations of certain ADL were not asked during usual care assessment. Other laboratory findings were not evaluated during the assessment. History of complications like Esophageal varices, Spontaneous Bacterial Peritonitis (SBP), portal hypertension was not evaluated. Subjects who underwent these minor procedures like Tapping(paracentesis) TIPS (Trans jugular Intrahepatic Portosystemic Shunt), band ligation, etc. was not analyzed. We could not procure some data such as duration and length of hospital stays during admission along with the reason for hospitalization.

FUTURE RECOMMENDATION

Proper rehabilitation with counselling can improve the outcome during the waiting period and post liver transplantation. Follow up assessment of frailty and repeat testing during waiting period and after transplantation can help in finding and managing the modifiable risk factors of frailty. Previous year's data and following future data can be synchronized and calibrated for further analysis, which may influence further outcome.

CONCLUSION

In summary, frailty is not synonymous with liver dysfunction or even with sarcopenia; it is a multidimensional construct that incorporates walking endurance, muscle strength, and balance. Frailty should not be used as the sole criterion for delisting a patient for liver transplantation, but rather should be considered one of many criteria when evaluating transplant candidacy and suitability and should not be ignored. Standardized assessments of frailty may be used to tailor the intensity and type of nutritional and physical therapy in patients awaiting and undergoing liver transplantation. Findings of this study imply that assessment of frailty can be used to guide future rehabilitation for such patients.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: Abdominal Organ Transplant department and Department of Physiotherapy Residents for data availability.

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Lai JC, Sonnenday CJ, Tapper EB, et al. Frailty in liver transplantation: An expert opinion statement from the American Society of Transplantation Liver and Intestinal Community of Practice. *Am J Transplant*. 2019;19(7):1896-1906. doi:10.1111/ajt.15392.
2. Dunn MA, Josbeno DA, Tevar AD, et al. Frailty as Tested by Gait Speed is an Independent Risk Factor for Cirrhosis Complications that Require Hospitalization. *Am J Gastroenterol*. 2016;111(12):1768-1775. doi:10.1038/ajg.2016.336
3. Essam Behiry M, Mogawer S, Yamany A, et al. Ability of the Short Physical Performance Battery Frailty Index to Predict Mortality and Hospital Readmission in Patients with Liver Cirrhosis. *Int J Hepatol*. 2019; 2019:8092865. Published 2019 May 2. doi:10.1155/2019/8092865
4. Lai JC, Feng S, Terrault NA, Lizaola B, Hayssen H, Covinsky K. Frailty predicts waitlist mortality in liver transplant candidates. *Am J Transplant*. 2014;14(8): 1870-1879. doi:10.1111/ajt.12762
5. Singh S, Taneja S, Tandon P, et al. A Comparison of Different Frailty Scores and Impact of Frailty on Outcome in Patients with Cirrhosis. *J Clin Exp Hepatol*. 2022;12(2):398-408. doi: 10.1016/j.jceh.2021.07.003
6. Pavasini R, Guralnik J, Brown JC, et al. Short Physical Performance Battery and all-cause mortality: systematic review and meta-analysis. *BMC Med*. 2016;14(1):215. Published 2016 Dec 22. doi:10.1186/s12916-016-0763-7
7. Lai JC, Volk ML, Strasburg D, Alexander N. Performance-Based Measures Associate With Frailty in Patients With End-Stage Liver Disease. *Transplantation*. 2016;100(12):2656-2660. doi:10.1097/TP.0000000000001433
8. Youden, W.J. (1950), Index for rating diagnostic tests. Cancer, 3: 32-35. https://doi.org/10.1002/1097-0142(1950)3:1<32: AID-CNCR2820030106>3.0.CO;2-3
9. Jones SE, Kon SS, Canavan JL, et al. The five-repetition sit-to-stand test as a functional outcome measure in COPD. *Thorax*. 2013;68(11):1015-1020. doi:10.1136/thoraxjnl-2013-203576
10. Tapper EB, Finkelstein D, Mittleman MA, Piatkowski G, Lai M. Standard assessments of frailty are validated predictors of mortality in hospitalized patients with cirrhosis. *Hepatology*. 2015;62(2):584-590. doi:10.1002/hep.27830
11. Alkhayat, K.F., Moustafa, G., Zaghloul, A., & Elazeem, A.A. (2017). Pulmonary Dysfunction in Patients with Liver Cirrhosis. *Archives of Medicine, 9*, 1-9.

How to cite this article: Roomy Ninama, Harda Shah, Pranjal Modi et.al. Does physical frailty and pulmonary function affect the number of hospital stay among liver cirrhosis patients? - a retrospective study. *International Journal of Science & Healthcare Research*. 2023; 8(1): 310-316. DOI: *https://doi.org/10.52403/ijshr.20230143*

******