



The quality of life of patients after liver transplantation

✉ Murat Tamer^a, ✉ Ayla Yava^b

^aTurgut Ozal Medical Center, Liver Transplantation Clinic, Malatya, Turkey

^bHasan Kalyoncu University, Faculty of Health Sciences, Department of Nursing, Gaziantep, Turkey

Abstract

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Aim: With increased survival rates after liver transplantation (LT), studies have focused on improving the quality of life in these patients. The purpose of this study is to assess the quality of life levels of recipients after LT.

Materials and Methods: This descriptive study was conducted with 103 voluntary patients between January 01-May 15, 2015. The sample of the study consisted of the patients who had liver transplantation and met the inclusion criteria. The data were collected using personal and disease information form and SF-36 health survey.

Results: It was found in the study that the mean score of the Physical Component Summary (PCS) was 39.90 ± 8.53 and the mean score of the Mental Component Summary (MCS) was 43.93 ± 9.86 . The patients who underwent LT had a moderate quality of life. The MCS score enhanced with increasing level of education. The PCS score is higher in those with men, single patients, cadavers as the source of transplantation, and those without a prolonging post-operative hospitalisation. Another finding of the study indicated that PCS score enhanced as the time elapsed after transplantation increased. In addition, patients with chronic diseases had lower physical health quality of life.

Conclusion: Although many complications develop in most of the patients, LT can make the patient more functional in many areas of life compared to their pre-transplantation life. The patients should be referred to other departments regularly to keep chronic diseases under control.



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Introduction

LT is a vital operation that gives patients, who have a chance to live less than a year, a chance to survive for ten years or longer. The studies have revealed that the three-month survival rate after LT is 91.2%, the five-year survival rate is 73.3%, and the ten-year survival rate is 60 (1, 2). The first LT was made in 1963 and Thomas Starzl and his team performed the first successful LT in 1967. In 1980, advances in surgical techniques, post-transplant use of immunosuppressive medication and the involvement of appropriate antibiotics into treatment positively affected patients' survival and quality of life (3, 4). While the primary objective of conventional healthcare sense is to treat the diseases and relieve the pain, current healthcare sense also involves sustaining the well-being and enhancing the quality of life. Therefore, the purpose of transplantation is to enhance the quality of life of the patients compared to their pre-transplant status, instead of prolonging the life expectancy. Although the survival of the patient in the short-term after liver transplantation is considered successful, the success of the long-term transplant is measured using the quality of life parameters of the recipient. As the most obvious proof related to this, most of the studies conducted after 2010 have focused on quality of life

rather than post-transplant life expectancy (1). All the health-care professionals should undertake significant duties for the patient to be satisfied in the post-transplantation process. The patients are mostly in communication with the nurses at every stage of this process. This communication attributes significant missions to the nurse for physical, mental, and spiritual rehabilitation of the patients along with their care, treatment, and follow-up. In their study, Forsberg et al., determined that the interaction between the nurse and the patient was effective in alleviating the patient's anxiety concerning the transplantation. Accordingly, Forsberg mentioned the need of establishing special support groups including the nurses in order to enhance the quality of life (5). Since liver transplantation does not have a long history, it is not possible to state that the number of studies in this field are sufficient. The number of the studies on quality of life is limited although the studies on LT surgery and post-surgery complication are higher in number.

Materials and Methods

This descriptive study was conducted with 103 voluntary patients between January 01-May 15, 2015. The study was approved by the institutional review board with approval number: 427170. The participants signed the informed consent form so that they were interviewed and the research team could use their data. The population of the study consisted of the patients who

Email address: murattamer44@hotmail.com (✉ Murat Tamer)

underwent LT in a university hospital between 2002 and 2015. The sample group included the patients who met the inclusion criteria of the study. The inclusion criteria were determined as follows; having undergone the LT at least 3 months ago, being aged 14 and over (Since SF-36 Quality of life scale is applied to the participants aged 14 and over), being able to communicate in Turkish, having no psychiatric disorder, not receiving any drug for such disorders, having no physical limitation to fill the data collection forms of the study, and being willing to participate in the study. The participants who wanted to withdraw from the study and did not fill in a great part of the data collection forms were excluded from the study.

Personal and Disease Information Form prepared by the researcher to collect socio-demographic data and disease-related data upon literature review. SF-36 health survey for identifying quality of life of the patients were used.

SF-36 Health Survey

Rand Corporation (Ware and Sherbourne) (1992) recommended the use of Short Form-36 (6). Comprising of thirty six questions, this survey is a self-report scale and allows measurement of quality of life at eight subscales: Physical Functioning (PF-10 items), Social Functioning (SF-2 items), Role Physical (RP-4 items), Role Emotional (RE-3 items), Mental Health (MH-5 items), Vitality (VT-4 items), Bodily Pain (BP-2 items), General Health (GH-5 items). There are two distinct concepts measured by the SF-36: a physical dimension, represented by the Physical Component Summary (PCS), and a mental dimension, represented by the Mental Component Summary (MCS) (7). PCS is associated with high scores on the PF, RP, BP and GH scales and MCS is associated with high score on the VT, SF, RE and MH (8).

Statistical Analysis

The data obtained in the study were analysed using SPSS 21 for Windows. Number (n), percentage (%), mean±standard deviation, and median were used in the descriptive statistics. SF-36 Health Survey mean scores were calculated as indicated above and lower subscale scores were identified. Shapiro Wilk-W test was used to appreciate the conformity of the data to normal distribution. Comparison of SF-36 mean scores of patients undergoing liver transplantation with descriptive information and disease information was realized with Independent Samples t-test if parametric conditions were met. if parametric conditions were not met, Mann-Whitney U Test was used in comparison of two groups and Kruskal Wallis Test was used in comparison of three and more groups. The value of $p < 0.05$ was taken as the statistical significance level.

Results

Table 1 shows the findings on descriptive characteristics of 103 patients undergoing liver transplantation. According to the table, 69.9% of liver recipients were men, mean age of the patients was 45.75 ± 14.75 . Half of the patients (50.5%) were aged 49 and below, 81.6% of the patients were married, and 47.6% were graduated from primary school. While 64.1% of the patients marked 'Yes' to the chronic disease question, 35.9% responded "No".

While the PCS score of the participants was 39.90 ± 8.53 , their MCS score was 43.93 ± 9.86 (Table 2). Table 2 shows SF-36

Table 1. Sample Characteristic

Descriptive Properties	Number	(n) %
Age (45.75 ± 14.75)		
≤49 Years	52	50.5
>50 Years	51	49.5
Gender		
Women	31	30.1
Men	72	69.9
Family Status		
Married	84	81.6
Single	19	18.4
Educational Background		
Illiterate	12	11.7
Primary School	49	47.6
Secondary School	17	16.5
High School	15	14.6
University	10	9.7
Chronic Disease		
Yes	66	64.1
No	37	35.9

subscale mean scores of the patients undergoing LT. When the subgroups were examined, it was determined that PCS score of the participants was 39.90 ± 8.53 , MCS score was 43.93 ± 9.86 , PF was 63.25 ± 26.29 , RP was 25.72 ± 25.35 , BP was 58.98 ± 24.04 , GH was 57.27 ± 23.80 , VT was 55.29 ± 22.10 , SF was 66.13 ± 27.54 , RE was 42.71 ± 35.98 , and MH score was 62.95 ± 18.65 (Table 2). Table 3 shows distributions of PCS scores and MCS scores according to some descriptive characteristics. The PCS score was higher in the men compared to the women and the difference between the mean scores was statistically significant ($p < 0.05$). The PCS score was higher in single patients than the married (43.78 ± 7.56 and 39.12 ± 8.59 respectively; $p < 0.05$). The PCS score was 41.25 ± 8.95 in patients with one chronic disease at minimum and 37.50 ± 7.23 in patients with no chronic disease ($p < 0.05$). The MCS score in patients undergoing LT was found to be 39.69 ± 12.01 in illiterate ones, 43.42 ± 8.69 in primary school graduates, 41.28 ± 9.71 in secondary school graduates, 46.40 ± 10.36 in high school graduates, and 52.32 ± 7.81 university graduates.

Table 4 shows distribution of MCS score and PCS score of the patients undergoing LT based on their medical diagnosis. It was found that MCS score and PCS score increased as the post-transplantation time increased and the differences in physical health dimension were statistically significant ($p < 0.05$). When MCS score and PCS score of the patients were examined in terms of source of transplantation, it was found that PCS score was found to be statistically significant ($p < 0.05$) and the patients receiving the liver from a cadaver had a higher quality of life score than those receiving from live donors. No statistically significant difference was found in the MCS score ($p > 0.05$). Similarly, when distribution of MCS score and PCS score was examined in terms of presence of conditions prolongating post-operative hospitalisation of the patients, PCS score was statistically significant ($p < 0.05$) and no statistically significant difference was found in the MCS ($p < 0.05$).

Table 2. SF-36 Components and Subscales Mean Scores of the Patients Undergoing Liver Transplantation (n = 103)

SCALES	Mean±SD*
PCS	39.90±8.53
MCS	43.93±9.86
PF	63.25±26.29
RP	25.72±25.35
BP	58.98±24.04
GH	57.27±23.80
VT	55.29±22.10
SF	66.13±27.54
RE	42.71±35.98
MH	62.95±18.65

PCS: Physical Component Summary; MCS: Mental Component Summary; PF: Physical Functioning; RP: Role Physical; BP: Bodily Pain; GH: General Health; VT: Vitality; SF: Social Functioning; RE: Role Emotional; MH: Mental Health

Table 3. Distributions of PCS and MCS Scores According to Some Descriptive Characteristics of the Patients (n = 103)

CHARACTERISTICS	PCS	MCS
	Mean±SD* Test, p	Mean±SD Test, p
Age		
<49 (n = 52)	40.16±8.66	43.75±9.52
>50 (n = 51)	39.64±8.48	44.11±10.28
	t= 0.306, p = 0.761	t=-0.188 p = 0.851
Gender		
Women (n = 31)	37.25±6.51	41.15±10.38
Men (n = 72)	41.04±9.07	45.13±9.46
	t=-2.100 p = 0.038	t=-1.903 p = 0.60
Civil Status		
Married (n = 84)	39.12±8.59	43.86±9.94
Single (n = 19)	43.78±7.56	45.02±9.37
	U=-2.168 p = 0.030	U=-0.233 p = 0.816
Educational Background		
Illiterate (n = 12)	36.15±7.21	39.69±12.01
Primary school (n = 49)	39.01±7.83	43.42±8.69
Secondary school (n = 17)	39.78±9.16	41.28±9.71
High school (n = 15)	42.34±9.21	46.40±10.36
University (n = 10)	45.34±9.35	52.32±7.81
	KW=7.175 p = 0.127	KW=10.927 p = 0.027
Chronic Disease		
Yes (n = 66)	41.25±8.95	44.35±9.64
No (n = 37)	37.50±7.23	43.18±10.32
	t=2.178 p = 0.032	t= 0.573 p = 0.567

PCS: (Physical Component Summary); MCS: (Mental Component Summary); SD: Standard Deviation

Table 4. Distribution of PCS and MCS Scores of the Patients Undergoing Liver Transplantation in Terms of Their Disease-Related Properties (n = 103)

CHARACTERISTICS	PCS	MCS
	Mean±SD* Test, p	Mean±SD* Test, p
Medical Diagnosis		
Hepatitis B (n = 89)	39.78±8.58	43.23±9.56
Other**(n = 14)	40.64±8.52	48.37±10.89
	U=-0.140 p = 0.889	U=-1.699 p = 0.089
Waiting Time for Transplantation (Days)		
Mean±SD=121.75±325.13; Median= 0.00; Min-Max= 0-1825		
Patients Who Did		
Not Wait (n = 57)	40.85±8.42	45.20±9.54
1-120 Days (n = 31)	38.40±9.35	42.46±10.19
121 Days and Above (n = 15)	39.41±7.13	42.13±10.31
	KW=1.078 t= 0.583	KW=1.875 t= 0.392
Time After Transplantation (Months)		
Mean±SD=27.39±21.35; Median=23.00; Min-Max=3-108		
3-6 months (n = 10)	35.86±10.11	38.13±8.12
6.1-12 months (n = 18)	33.20±6.72	43.37±10.43
12.1-24 months (n = 36)	41.44±7.52	44.88±9.37
24.1-48 months (n = 24)	41.22±8.32	44.41±12.29
48.1 months and above (n = 15)	44.85±7.07	45.32±6.04
	KW=20.325 p = 0.001	KW=5.021 p = 0.285
Source of Transplantation		
Live (n = 89)	39.21±8.19	43.33±9.71
	44.73±8.73	45.77±8.51
	U=-2.215 p = 0.027	U=-0.838 p = 0.402
Prolongating Post-operative Hospitalisation		
Mean±SD=41.40±33.45; Median=30.00 Min-Max=10-180		
Yes (n = 35)	36.99±8.92	41.92±10.33
No (n = 68)	41.40±7.98	44.96±9.52
	t=-2.547 p = 0.012	t=-1.489 p = 0.140

Discussion

Results of the present study revealed that while the PCS score of the participants was 39.90±8.53, their MCS score was 43.93±9.86 (Table 2). When the scores received by the participants in similar studies using quality of life scales were examined, PCS and MCS scores were respectively 36.40 and 82.34 in the study by Beilby et al. (2003) (9); 54.38 and 68.23 in the study by Krawczyk et al. (2018) (10). In their study, Dabrowsa-Bender et al., determined that the quality of the lives of the 47.5% of the patients was good and 19.3% were very good (11). PCS scores were 39.3 (adults) and 49.2 (children) and

MCS scores were 56.4 (adults) and 48.6 (children) in the study by Sullivan et al., (2014) (12). As is seen, quality of life mean scores of patients in the related studies are different from one another, but still they are higher than the quality of life scores in the present study. The difference between quality of life scores might stem from the cultural differences among the countries, study design, characteristics of sample group, and differences in sample sizes.

When quality of life subscale scores obtained in the present study were compared with the other studies, it was remarkable that all the sub-scale mean scores except for vitality were significantly low. In the study by Krawczyk et al., (2018), liver recipients showed a significant improvement in many areas compared to the mean scores before transplantation. When compared to healthy individuals, their physical functionality, physical role, emotional role, and PCS scores were worse (10). Such results may be associated with study designs, properties of sampling and cultural factors as indicated above. Although the study group is similar to the other studies in terms of socio-demographic and disease-related characteristics, the low quality of life of the patients in the present study makes us think that other factors might also play a role. Therefore, studies to be conducted using study designs with a wide participation and other variables that might affect the quality of life are needed.

The results of the study indicated that average age of 103 liver recipients included in the sample group was in the middle age group (45.75 ± 14.75) (Table 1). This might be explained by the fact that liver diseases reached the highest prevalence in 30s-40s and majority of the patients undergoing liver transplantation consisted of middle-aged individuals. In the present study, no significant correlation was found between age and quality of life. In their studies Aberg et al. (2009) (13) and Dąbrowska-Bender et al., concluded that quality of life decreased with increasing age and there was a decrease in physical function especially in recipients over 40 years of age (14). Bownik et al., found a significant decrease in the general health status of the recipients older than 60 years compared to the pre-transplant period. In addition, this was associated with pain, acute organ rejection, decreased physical activity, and mental and emotional disorders (15). In their study, Dąbrowska-Bender et al., (2018) showed that patients over 40 years old reduced physical performance and patients over 50 years old suffered more often from bodily pain (14).

Nearly two thirds of the participants (69.9%) in the study were men (Table 1). Accordingly, it was found that liver transplantation was more common with the men compared to the women. In the present study, it was found that PCS score of the men undergoing liver transplantation was higher than the score of the women. The studies by Van Der Plus et al. (2003), Saab et al. (2011), Zahn et al. (2013) and Dąbrowska-Bender et al. (2018) revealed that PCS and MCS scores of the patients undergoing liver transplantation did not vary according to the gender (14, 16-18). Cowling et al (2004) stated that men tended to have a better perception of their quality of life both before and after transplantation when compared to women (19). Bianco et al., (2013) investigated patient with HCV-associated liver cirrhosis at least 1 year after liver transplantation. They showed that women had a better quality of life in terms of mental health and emotional functioning (20). The women had a lower physical health quality of life compared to the men, which might be due to the fact that they were exposed to more stressors because of

their societal role and their requirement for more support.

As seen in Table 3, PCS score of single recipients was higher than the score of the married patients. Dąbrowska-Bender et al., (2018) reported that marital status had no correlation with a better quality of life compared to the other groups (i. e., single, divorced, widow/widower) (14). The single patients might be affected by the psychosocial effects of the disease at minimum level because they are younger and have no children and no family to provide for. Besides, the economic liability of the single liver recipients was undertaken by their families and this might have enabled their quality of life to be affected less. It was found in the present study that MCS score increased as recipients' educational background increased. It was considered that healthcare understanding would change and improve positively as the education level increased. The individuals would undertake their self-care responsibility more, accordingly they would learn and use strategies of coping with the post-transplantation complications and thus their quality of life would enhance.

In the present study, it was observed that PCS scores of the recipients with chronic disease decreased. Majority of the patients underwent liver transplantation due to cirrhosis caused by Hepatitis B (HBV) (86.4%). HBV is the most common type of viral infections of liver. Similarly, the biggest reason for transplantation is development of cirrhosis due to HBV (21). PCS and MCS score of the patients undergoing liver transplantation were not statistically significant in terms of medical diagnosis. Mean waiting time of the patients for liver transplantation was nearly four months and more than half of the patients (55.3%) did not wait at all.

In the present study, PCS score of the patients undergoing liver transplantation increased as the time elapsing after transplantation increased. Krawczyk et al. (2018), concluded in their study that there was no difference between patients who had a long time passed over liver transplantation and patients, who did not have too much time, in terms of health-related quality of life (10). Kotarska et al. (2014), reported that the patients preferred to live more sedentary because of physical pain that may occur due to physical activity within 6-12 months after transplantation. They concluded that physical activity of the patients increased and overall health status improved significantly 2-3 years after transplantation (22). Krasnoff et al. (2005), reported that – 2-24 months after liver transplantation, patients showed an improvement in physical functioning as well as an increase in muscle strength (23). In the study conducted by Ortega et al., (2009) by comparing SF-36 dimensions before and after transplantation, they observed significant improvements in mental dimensions. Additionally, they compared 3-12 months after transplantation and found significant improvements only in RP, PF, and PCS (24). In their study, Onghena et al., (2016) determined that there was a significant increase in the quality of life of patients for one year after LT, and the quality of life did not enhance after the first year of transplantation (1). Bownik et al., stated in their study that the more time passed after the organ transplantation, the better quality of life could be evaluated (15).

Majority of the participants (86.4%) underwent transplantation using the liver from the living donors. The results of the study revealed that the patients receiving liver from a cadaver had higher PCS score compared to those receiving liver from living donors . However, it is difficult to state that donor's character-

istics are effective on quality of life. Therefore, it is considered that it will be useful to investigate this condition in further studies.

In the present study, the presence of conditions prolonging the post-operative hospitalisation of patients decreased patients' PCS score continuous use of immunosuppressive agents and recurrent infections in the post-operative period adversely affect the quality of life. In spite of these problems, quality of life indicators were found to be better in many patients compared to the pre-transplant period (25). In their study, Aberg et al., found that the incidence of post-transplantation complications and deficiencies in the living spaces of some patients did not significantly affect the perceived quality of life of the patient (13).

Conclusion

Although many complications develop in most of the patients, LT can make the patient more functional in many areas of life compared to their pre-transplantation life. The patients should be referred to other departments regularly to keep chronic diseases under control. Quality of life perceived by patients could be improved with programs to improve physical aspects. In addition, psychosocial support can be provided with a multidisciplinary team to improve the quality of life of liver recipients.

Ethical approval

Ethical approval was obtained from Inonu University Ethical Committee.

References

1. Onghena L, Develtere W, Poppe C, Geerts A, Troisi R, Vanlander A, et al. Quality of Life After Liver Transplantation: State of The Art. *World Journal of Hepatology*. 2016;8(18):749-756.
2. Saidi RF. Current Status of Liver Transplantation. *Arch Iran Med* 2012;15(12): 772-776
3. Dias FF, Almeida SS, Almeida MD. Assessment and Enrolment Process for Liver Transplantation: Nursing Management Through Quality Indicators. *Einstein (Sao Paulo)* 2018;16(1): eAO3975
4. Akbulut S, Yilmaz S. Liver transplantation in Turkey: Historical Review And Future Perspectives. *Transplantation Reviews* 2015;29(3):161-167.
5. Forsberg A, Bäckman L, Möller A. Experiencing Liver Transplantation: A Phenomenological Approach. *Journal of Advanced Nursing* 2000;32(2):327-334.
6. Rand Corporation Web Page. 36-Item Short Form Survey. https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html. Date of Access: 20.05.2021
7. Lins L, Carvalho FM. SF-36 Total Score As A Single Measure of Health-Related Quality of Life: Scoping Review. *SAGE Open Med*. 2016;(4):1-12
8. Physical Component Summary. In: Preedy VR, Watson RR, editors. *Handbook of Disease Burdens and Quality of Life Measures*. New York, NY: Springer New York; 2010. p. 4286-7.
9. Beilby S, Moss-Morris R, Painter L. Quality of Life Before and After Heart, Lung and Liver Transplantation. *New Zealand Medical Journal*. 2003;116(1171).
10. Krawczyk M, Koźma M, Szymańska A, et al. Effects of Liver Transplantation on Health-Related Quality of Life In Patients With Primary Biliary Cholangitis. *Clin Transplant*. 2018;32(12):e13434.
11. Dąbrowska-Bender M, Michałowicz B, Pączek L. Assessment of The Quality of Life In Patients After Liver Transplantation As An Important Part of Treatment Results. *Transplantation Proceedings*; 2016;48:1697-1702
12. Sullivan KM, Radosevich DM, Lake JR. Health-Related Quality of Life: Two Decades After Liver Transplantation. *Liver Transplantation*. 2014;20(6):649-654.
13. Åberg F, Rissanen AM, Sintonen H, Roine RP, Höckerstedt K, Isoniemi H. Health-Related Quality Of Life And Employment Status Of Liver Transplant Patients. 2009;15(1):64-72.
14. Dąbrowska-Bender M, Kozaczuk A, Pączek L, Milkiewicz P, Słoniewski R, Staniszevska A. Patient Quality Of Life After Liver Transplantation In Terms Of Emotional Problems And The Impact Of Sociodemographic Factors. *Transplantation Proceedings*. 2018;50:2031-2038.
15. Bownik H, Saab S. Health-Related Quality Of Life After Liver Transplantation For Adult Recipients. *Liver Transplantation*. 2009;15(S2):S42-S49.
16. Van Der Plas SM, Hansen BE, De Boer JB, Stijnen T, Passchier J, De Man RA, et al. Generic and Disease-Specific Health Related Quality Of Life In Non-Cirrhotic, Cirrhotic And Transplanted Liver Patients: A Cross-Sectional Study. *BMC Gastroenterology*. 2003;3(1):33.
17. Saab S, Bownik H, Ayoub N, Younossi Z, Durazo F, Han S, et al. Differences in Health-Related Quality Of Life Scores After Orthotopic Liver Transplantation With Respect To Selected Socioeconomic Factors. *Liver Transplantation*. 2011;17(5):580-590.
18. Zahn A, Seubert L, Jünger J, Schellberg D, Weiss KH, Schemmer P, et al. Factors Influencing Long-Term Quality Of Life And Depression In German Liver Transplant Recipients: A Single-Centre Cross-Sectional Study. *Ann Transplant*. 2013;18:327-335.
19. Cowling T, Jennings LW, Goldstein RM, Sanchez EQ, Chinnakotla S, Klintmalm GB, et al. Liver Transplantation And Health-Related Quality Of Life: Scoring Differences Between Men And Women. *Liver Transplantation*. 2004;10(1):88-96.
20. Bianco T, Cillo U, Amodio P, Zanusi G, Salari A, Neri D, et al. Gender Differences In The Quality Of Life Of Patients With Liver Cirrhosis Related To Hepatitis C After Liver Transplantation. *Blood Purif*. 2013;36(3-4):231-236.
21. Isik A, Firat D, Soyuturk M, Demiryilmaz I, Yilmaz I. Idiopathic Periportal Lymphadenopathy . *GMJ*. 2016;27:51-52.
22. Kotarska K, Wunsch E, Kempnińska-Podhorodecka A, Raszejka-Wyszomirska J, Bogdanos DP, Wójcicki M, et al. Factors Affecting Health-Related Quality Of Life And Physical Activity After Liver Transplantation For Autoimmune And Nonautoimmune Liver Diseases: A Prospective, Single Centre Study. *Journal of Immunology Research*. 2014; 9.
23. Krasnoff JB, Vintro AQ, Ascher NL, Bass NM, Dodd MJ, Painter PL. Objective Measures Of Health-Related Quality Of Life Over 24 Months Post-Liver Transplantation. *Clin Transplant*. 2005;19(1):1-9.
24. Ortega T, Deulofeu R, Salamero P, Casanovas T, Rimola A, Pont T, et al. Impact of Health Related Quality Of Life In Catalonia Liver Transplant Patients. *Transplantation Proceedings*. 2009; 41: 2187-2188.
25. Karam V, Sebah M, Rifai K, Yilmaz F, Bhangui P, Danet C, et al. Quality Of Life 10 Years After Liver Transplantation: The Impact Of Graft Histology. *World J Transplant*. 2016;6(4):703-711.